FOREST INVENTORY AND ANALYSIS
SOUTHERN RESEARCH STATION FIELD GUIDE

VOLUME 1: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

VERSION 1.71

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SOUTHERN RESEARCH STATION FIELD GUIDE

VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

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INTRODUCTION

This document describes the standards, codes, methods, and definitions for Forest Inventory and Analysis (FIA) field data items. The objective is to describe CORE FIA field procedures that will be consistent and uniform across all FIA units. **This CORE serves as the framework for regional FIA programs; individual programs may add variables, but may not change the CORE requirements.**

This document also describes additional regional standards, methods, and definitions for the southern FIA unit. This serves to enhance the National CORE, not change it. All regional items and clarifying text are shaded in the same manner as this paragraph.

A vertical bar in the left margin, just like the one next to this paragraph, identifies text that has changed since the previous update. A bar may also be next to empty lines between paragraphs, at the top or bottom of a page, and even next to some lines of text that have not actually changed. In this case, it merely indicates a line spacing change. Updated pages that do not have a vertical bar in the left margin are included as a result of a shift in the page order.

It is expected that all items in Volume I can be measured by a two-person field crew in less than a single day, on average, including time spent travelling to and from the plot.

The FIA program is in transition, changing in response to legislation and new customer demands. One of these demands is for increased consistency, which this manual begins to address. Another change is the merger of the FIA program with the field plot component of the Forest Health Monitoring (FHM) program. This will be accomplished by a joint sampling approach where FHM plots become a subset of the larger sample of FIA plots. In this model, plots formerly known as FIA plots will now be called Phase 2 plots; plots formerly known as FHM plots will be called Phase 3 plots.

The focus of Volume I is on data that are collected in the field on all Phase 2 plots in the FIA sample and on mensuration add-ons collected on Phase 3 plots. Volume II of the series will describe an additional expanded suite of data collected on the Phase 3 subsample. Volume II will consist of the FHM field manual, minus data elements already collected on the FIA sample. Volume III of the series (in preparation) will document the office procedures including data elements measured in the office, data from other sources that are merged into the FIA database, and CORE compilation and analysis algorithms. When complete, the three-volume set will describe all field data measured consistently across the country, comprising the CORE FIA program.

FIELD GUIDE LAYOUT

Each section of the field guide corresponds to one of the following sections:

0 General Description
1 Plot
2 Condition
3 Boundary
4 Subplot
5 Tree Measurements
6 Seedling
7 Site Tree
8 Nonforest/Denied Access/Hazardous Plots

Each section begins with some general overview of the data elements collected at that level, along with whatever technical background is necessary to prepare the field crews for data collection. Descriptions of data elements follow, in the following format:

ITEM # DATA ELEMENT NAME -- <brief variable description>

When collected: <when data element is recorded>
Field width: <X digits>
Values: <legal values for coded variables>

Item numbers are four digits and attempt to adhere to the section number of the National Core Field Guide that describes the variable. The first digit of the item number indicates the section it can be found in the manual. For example, AZIMUTH is ITEM 5040, because it is found in section 5.04 of the national manual. Items that begin with the letter 'R', indicates the items of regional interest that are not in the national manual. In this case, the second digit indicates the section that the item can be located. For example, NEW PAST FOREST TYPE is a regional item. It is item number R207. The 'R' indicates it is a regional item, the '2' indicates it can be found in Section 2, Condition.

Data elements and descriptions of when to collect, field width, and values, apply to both Phase 2 plots (formerly called FIA plots) and Phase 3 plots (formerly called FHM plots) unless specifically noted.

UNITS OF MEASURE

The field guide will use ENGLISH units as the measurement system. Puerto Rico and the Virgin Islands will use METRIC. See Supplement C for ENGLISH/METRIC conversion of plot and tree limiting dimensions.

Plot Dimensions:

Annular plot - for sample intensification or sampling relatively rare events and for coding some condition level data.

Radius = 58.9 ft
Area = 10,890 sq. ft or 0.25 ac or 1/4 ac

Subplot - for selecting trees with diameter $\geq$ 5.0 in

Radius = 24.0 ft
Area = 1,809.56 sq. ft or approximately 0.04 ac or approximately 1/24 ac

Microplot - for counting seedlings and selecting saplings

Radius = 6.8 ft
Area = 145.27 sq. ft or approximately 0.003 ac or approximately 1/300 ac

The distance between subplot centers is 120.0 ft horizontal.
The minimum area needed to qualify as accessible forest land is 1.0 ac.
The minimum width to qualify as accessible forest land is 120.0 ft

Tree Limiting Dimensions:

breast height	4.5 ft
stump height	1.0 ft
merchantable top	4.0 in
merchantable top for woodland	1.5 in
minimum conifer seedling length	0.5 ft
minimum hardwood seedling length	1.0 ft
seedling/sapling DBH/DRC break	1.0 in
sapling/tree DBH/DRC break	5.0 in

0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24 ac in size with a radius of 24.0 ft. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 ft horizontal at azimuths of 360, 120, and 240 degrees, respectively from the center of subplot 1. See Figure 1. Subplots are used to collect data on trees with a diameter (at breast height "DBH", or at root collar "DRC") of 5.0 in or greater. Throughout this manual, use of the word 'plot' refers to the entire set of four subplots. “Plot center” is defined as the center of subplot 1.

Each subplot contains a microplot of approximately 1/300 ac in size with a radius of 6.8 ft. The center of the microplot is offset 90 degrees and 12.0 ft horizontal from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH of 1.0 in to 4.9 in) and seedlings (DBH less than 1.0 inch in diameter and greater than 0.5 ft in length (conifers) or greater than 1.0 ft in length (hardwoods)). Longleaf pine must be at least 0.5 in at the root collar. Planted seedlings must meet the same size requirements as listed above.

Data are collected on field plots at the following levels:

Plot	Data that describe the entire cluster of four subplots.
Subplot	Data that describe a single subplot of a cluster.
Condition Class	A discrete combination of landscape attributes that describe the environment on all or part of the plot. These attributes include CONDITION STATUS, RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY.
Boundary	An approximate description of the demarcation line between two condition classes that occur on a single subplot, microplot, or annular plot. There is no boundary recorded when the demarcation occurs beyond the fixed radius plots.
Tree	Data describing saplings with a diameter 1.0 in to 4.9 in, and trees with diameter $\geq$ 5.0 in
Seedling	Data describing trees with a diameter < 1.0 inch and $\geq$ 0.5 ft in length (conifers) or $\geq$ 1.0 ft in length (hardwoods). Longleaf pine must be at least 0.5 in at the root collar. Planted seedlings must meet the same size requirements as listed above.
Site Tree	Data describing site index trees.

0.1 PLOT SETUP

Mark each subplot and microplot center with a wire pin. Bend the pin at the subplot center in a "horseshoe" shape. The center of the bend represents subplot center. Bend the pin at the microplot center in a "pig tail" shape. Place pins at all subplot and microplot centers that contain an accessible forest condition, even if there is no tally on the subplot or microplot.

Plots will be established according to the regional guidelines of each FIA program. In cases where the plot center cannot be occupied due to safety hazards, lack of access, or when the plot center is out of the sample, but some of the subplots can be occupied and are in the sample, those subplots which can be established should be established and sampled according to normal procedures. In cases where a subplot or microplot center cannot be occupied no data will be collected from that subplot or microplot; instead, the entire subplot or microplot should be classified according to the condition preventing occupancy (i.e. Census water, denied access, hazardous, etc.).

The table provided below can assist in locating subplot 2-4 from a subplot other than subplot 1.

Subplot Numbers		Azimuth	Backsight	Distance
From	To	*degrees*		*feet*
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

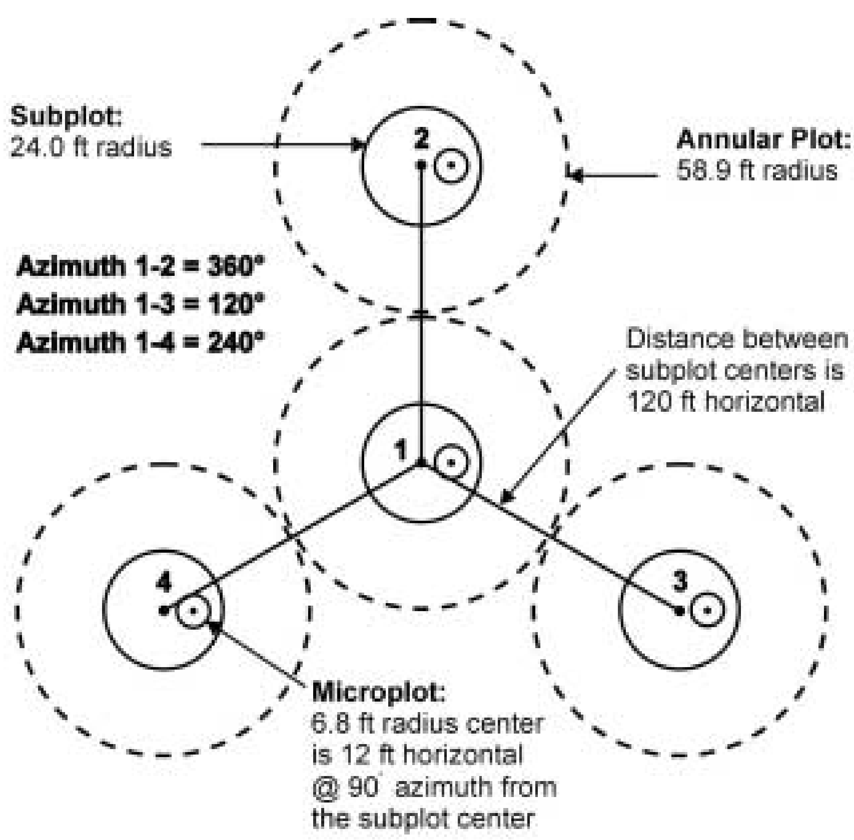


Figure 1. FIA plot diagram.

0.2 PLOT INTEGRITY

Each FIA program is responsible for minimizing damage to current or prospective sample trees and for specifying how these trees are monumented for remeasurement. The following field procedures are permitted:

- Scribing and nailing tags on witness trees so that subplot centers can be relocated.

- Boring of trees for age on subplots and annular plots to determine tree age, site index, stand age, or for other reasons.

All other potentially damaging procedures that may erode plot integrity are prohibited.

The following practices are specifically prohibited:

- Boring and scribing of some specific tree species, such as quaking aspen, that are known to be negatively affected (i.e., the initiation of infection or callusing).

- Chopping vines from tally trees. When possible, vines should be pried off trunks to enable accurate measure. If this is not possible, alternative tools (calipers, biltmore sticks) should be used.

0.3 OWNERSHIP INFORMATION

Ownership information is recorded on all accessible forest land conditions. Prior to actual fieldwork in a county, ownership data is collected from county courthouse records. It is important to gather as much information as possible on the initial visit to the courthouse to avoid a return visit while the fieldwork is occurring.

NOTE: If the ownership has changed either from or to National Forest, the state coordinator or field supervisor must be notified.

SURVEY SYSTEMS
There are two primary boundary surveys: metes-and-bounds and Public Land Survey (PLS). The metes-and-bounds method uses map and parcel whereas the PLS uses section, township, and range to describe boundaries. Field crews should become familiar with the method used in the state.

INITIAL COUNTY OVERVIEW
Review the county materials to determine which plots were forested on the previous survey. Also, determine if any of the plots were recorded as idle farmland, which may have reverted since the last inventory. In addition, examine the aerial photographs to determine other plot locations that may have reverted and/or partially sample forest land. Be sure to collect ownership information on these plots. Owner data is not required on nonforest plots.

COUNTY RECORDS

Record keeping systems varies both between and within states. Some counties are highly computerized, while some rely totally on paper. Some counties have up-to-date information, while others are outdated. It is always advisable to ask for help from courthouse employees. They are there to help the public and are generally eager to assist people. They can also be invaluable sources of information for local forest industries.

GENERAL OWNERSHIP PROCEDURES:

1. Determine if the plot location samples forest land. Keep in mind the plot layout. One or more of the subplots may sample forest land. This is where preliminary work is beneficial.

2. Locate the plot location on county courthouse tax maps using the aerial photograph. When available, rely primarily on the old photograph to locate the plot on the county tax maps. Also use the plot sketch from the previous survey. It may show distinguishing physical characteristics that may help delineate the ownership boundaries. If there is more than one parcel in the vicinity of the plot, record information for each possible parcel. The adjacent tract may be in another owner category or may help you gain access to the plot.

3. Record the name, address, and owner class for the owner of each parcel. Cross check the owner with the past survey to verify an actual ownership change or if either the current or previous assignment was in error.

4. Determine the total acreage of each parcel and the number of forest acres, if required. Woodland acres are broken out of the total acreage in some states and can be used to determine percent forest. In other states, however, pine plantations are included in the agriculture category. In these cases, use the aerial photograph and the field visit to estimate the percent forest of the tract. Field check the percent forest information when the plot appears to have been planted, naturally reverted, or land cleared.

5. Record all pertinent ownership information on the “Forest Land Ownership Classification” sheets and the “Sample Location Reference Page.”

0.4 LOCATING SAMPLE PLOTS

Each crew should always consider weather forecasts, water levels, plot access, and state and corporate cooperation when working a county. Each county should be worked in the most efficient manner possible. Always contact National Forest System (NFS) district and county forest offices, and county sheriff, as soon as you enter the county. Contact the landowner and always let local people know who you are and what you are doing when leaving an official vehicle near a residential area.

STOP AT HOUSES, KNOCK ON DOORS, ETC. DO NOT DRIVE ACROSS CROPLAND, WILDLIFE CLEARINGS, YARDS, ETC. UNLESS YOU HAVE PERMISSION FROM THE LANDOWNER. PARK THE VEHICLE AND WALK. ”POPPING” A LOCK OR USING A MASTER KEY WILL NOT BE TOLERATED. IF A ROAD HAS WATER-BARS OR A CABLE WITH A LOCK DO NOT DRIVE.

Fill out a sample location sheet (draw sheet) for all forested plots and non-forest plots whenever a non-forest plot has adjacent forestland close to the plot. This will insure that all 4 subplots are completely and totally within the non-forest condition. This will aid cruisers in the next survey to identify those plots that may have started to revert, but did not meet the required minimum stocking. In addition, this will allow check cruisers know exactly where PC was located in relation to the adjacent forestland. A sample location sheet is not required for intensification plots, although data from intensification plots are recorded in the data recorder or on hardcopy.

Each crew will be furnished with both new and old photos (when available), plot sheets, ownership and field classification sheets, county maps, and National Forest ownership maps. All non-forest plots and possible reversions (a sample location or a portion of a sample location that was non-forest in the previous inventory but now forest) must be chained in using the old photo pinprick. Correct the pinprick on the new photo after the field visit if needed. For intensification plots, only use the new photos. Do not make any corrections to the new photo for an intensification plot.

ACCESS TO STARTING POINT (SP)
In the Sample Location Reference page section “SP Location Sketch Map” sketch the route used to access the SP. Include location of the landowners’ house, road names and numbers, obvious landmarks, and other prominent features that will aid the next field crew to locate the SP.

STARTING POINT
Select a permanent landmark or physical feature as the SP for locating the sample location. Intersections or sharp bends in roads, streams, or drainage ditches, field corners, prominent trees, and other features which can be readily identified both on the ground and on the photo make good starting points. The ideal starting point tree is a healthy, unique species, with unusual form, in a prominent location. At remeasurement relocations, the starting point on the old location sheet can often be used again. Scribe the SP tree with an “X” well above DBH (or well below depending on topography) and tag the tree at ground level, facing plot center.

Complete a new location sheet with the prior starting point information on land clearings, possible reversions that are chained into that do not meet minimum stocking levels, and on non-forest plots that are close to being partial plots. Copy the starting point information off the old sheets for any non-forest plots when the previous cruiser recorded the information. A starting point is not necessary if the plot center was non-forest during the past survey and all four subplots are obviously non-forest at the present time.

Note: No mark is needed on an SP if the point is permanent and readily identifiable, such as the corner of a building or a road intersection. Reference a tree when possible.
Photo Azimuth and Distance

PHOTO WORK
A reference azimuth, angle of intersection, and azimuth to plot center are drawn on the photograph to aid in the establishment of an accurate course to sample location, verify placement of the pinprick, and ground check the office photo interpretation.

All plots except intensification plots must be drawn up on the new photograph to verify correct plot location. Note any corrected pinpricks on the front and back of the new photo.

Reference Azimuth
For a reference azimuth, select a straight road section, drainage ditch, field edge, or draw a line between two well-spaced landmarks. Avoid standing near metal objects, e.g., railroads or power line towers, since they can influence the compass reading.

If no linear features exist on the photo, GPS coordinates of two point features can be used to obtain a reference azimuth. Prior to driving to the sample location, identify two distinct features on the photo within a reasonable distance (usually 1-2 miles) from the sample location. At each point feature, record 180 fixes in averaging mode on the GPS receiver (GPS can only be utilized when error falls below +/- 70 feet). The reference azimuth, based on magnetic north, is determined by using the distance feature in the WP menu of the PLGR.

Measure the reference azimuth with a compass to the nearest degree and record on the tally sheet under starting point notes, disregarding magnetic declination. If the reference azimuth line and the azimuth to plot center do not intersect on the photo, draw a line perpendicular to the reference azimuth line making it cross the azimuth to plot center. Use the perpendicular as the new reference azimuth line after adding or subtracting 90.

Angle of Intersection
With a protractor measure the interior angle between the reference azimuth and azimuth to plot center arrows to the nearest degree. The interior angle should be between 20 degrees and 90 degrees. Record on the tally sheet under starting point notes.

Photo Notation

Note the following information on the **front** of the new photograph using a fine point marker for all plots:

a. Reference azimuth line with an arrow indicating direction and azimuth noted.
b. Course to plot azimuth line with an arrow indicating direction and azimuth noted.
c. Starting Point circled and indicated as SP.
d. GPS Way Point circled and indicated as WP for completely non-forest plots only.
e. Interior angle noted with arrows drawn to the azimuth lines.
f. Note which plots have corrected pinpricks.

Note the following information on the **back** of new photographs when plot center is nonforest (e.g., partials and completely nonforest plots), if the plot is completely inaccessible, and intensification plots:

a. Plot number, if not already noted.
b. Land use code at plot center. If land use is a hayfield, record cropland land use (11) and write “hay” next to the code number. If the land use is developed (30 series codes), write a short description of the type of development, e.g., “back yard”, “grocery store”, etc. This will aid the next crew to ensure the same area is re-evaluated.
c. Date (mm/dd/yyyy).
d. Cruiser and assistant initials and codes.
e. Circle and note the “correct” pinprick if a correction has been made (do not move intensification pinpricks).
f. Recording GPS coordinates of non-forest plots on the back of the photo is optional.

Also, note on the back of the new photograph if plot center is reverted or landcleared.

COURSE TO PLOT

The course to sample location can be determined by measurements from the photo for new plot locations, reversions, partials, or land clearings and lost plots when the SP has been removed. The azimuth and distance can be determined using GPS or compass and chain. Pacing to most locations is possible unless underbrush, water, or rough topography make pacing impractical. Pacing between SP and PC can be used to verify a previously reported course to sample location, but not for establishing a plot.

When old starting points are used at remeasurement locations, use the same distance and azimuth recorded in the previous survey with corrections necessary to account for declination and errant distances recorded by the previous crew. Accurate measurement of azimuth and distance from SP to PC can be by GPS navigation or by traversing on the ground.

ESTABLISHMENT OF SAMPLE KIND 1 LOCATIONS USING GPS

To begin, manually enter the plot coordinates in the GPS unit. The following list will walk you through the buttons to push to enter the coordinates:

1. WP
2. Use the right/left arrows to highlight ENTER and press the down arrow.
3. Note the WP number in the upper left corner of the screen. This will be the waypoint the coordinates are stored as and to which you will be navigating, so it is an important number. It is a good idea to change the waypoint number to coincide with the number of the plot you are installing. To do this, right arrow until the number is blinking. Hit NUM LOCK and using the keypad, enter the plot number. Hit NUM LOCK again to turn it off. Right arrow to the next line.
4. Right arrow over N to 90. Hit NUM LOCK and enter the coordinates for North/latitude. Once these numbers have been entered, hit NUM LOCK and right arrow to the next line. **Down arrow to change the E to a W.** This is critical! The GPS default is East. If you do not change this designation, you will be putting in and navigating to coordinates in the eastern hemisphere and unless you can swim really fast and really well, you don't want to do that! Once you have changed the E to a W, right arrow to the 000 and hit NUM LOCK. Enter the West/longitudinal coordinates.
5. Once the coordinates have been entered, turn off NUM LOCK and right arrow to the P. Down arrow to store the waypoint. It will be saved as the waypoint you designated earlier.

Next, click on NAV. Make sure that you are using either the CUSTOM or 2D FAST navigating method. The other word should be DIRECT. Right arrow to WP and enter the waypoint you want to navigate to. Right arrow to P and down arrow. The next screen will tell you where you need to go. The variables may not be the same for everyone, but you need to at least have AZ and RNG to tell you where you need to go and how far it is.

Using the GPS, navigate to within 100' – 150' of the plot. If possible, locate a good SP. Set the GPS down and press and hold down the POS button until the screen says AVG and the unit begins taking hits. Again, you must collect at least 180 points for the coordinates to be accurate. Once the GPS has reached at least 180, store the current position as a waypoint. Next, hit WP. Right arrow to DIST and down arrow. This screen will allow you to calculate an azimuth and horizontal distance between two waypoints. As the first waypoint, put in the coordinates you collected at the SP. The second waypoint is the plot coordinates. Once both have been entered, the GPS calculates the RNG and AZ from the first WP to the second WP. At this point, chain the horizontal distance and azimuth to establish plot center. Once you are at PC, put the GPS down and press and hold the POS key to begin averaging. Again, take at least 180 hits. Record these coordinates as the new plot coordinates.

WITNESS TREES
Reference two witness trees to subplot 1 when at all possible. In the absence of trees, use distinct objects such as fence corners, boulders, etc. If another subplot is referenced, be sure to note which subplot is monumented with witness trees.

Witness trees should be:

a. Close to the pin and spaced approximately at right angles from the pin,
b. Not likely to die or be cut within 5-7 years, e.g., pine sawtimber,
c. A species easily located in the stand,
d. At least 5 inches DBH (At least 2 inches DBH if no 5 inch DBH trees are present).
e. If there are no witness trees, use whatever is available near the subplot center and describe its' relationship to the pin (e.g., large down log that you can tag, a large rock, etc.) and describe these on the sample location reference page.

Witness tree data:

a. Species
b. DBH to the last 0.1 inch
c. Azimuth from pin to center of tree at ground level
d. Horizontal distance to 0.1 ft from pin to center of tree

Mark the base of each witness tree with a metal tag (3 to 4 inches long) facing plot center. Scribe an “X” well above DBH facing the pin and be careful not to penetrate the cambium.

Mark one of the witness trees with a designated tag (venetian blind material) by nailing the tag at approximately six feet facing the line of approach from the SP. Record the color of the tag on the sample location page.

0.5 COUNTY EDIT PROCEDURES

The field is the most critical place to edit data for errors. Correcting the data in the field is more precise and accurate than doing so after being submitted to the office. For this reason, a careful field edit is a vital part of data collection.

Count all county materials and complete the Office Summary Sheet. Ensure that all materials are accounted for before starting the county. If anything is missing when you receive the county materials (i.e., old maps, any photos, plots sheets, etc.) let your field coordinator know.

Make sure all items are filled in on the on the Sample Location record. Check for starting point notes, azimuth and slope distance to the sample location, and that the SP description and Sketch to Sample Location match. Check completeness of the plot layout diagram, Location Sketch Map, and Sketch to Sample Location. Make sure all plots have a North arrow and the Ownership is recorded. Check the witness tree information for completeness.

Check the photographs making sure that all the SP's are marked, the photographs are drawn-up, and all required information is recorded on the back of the photographs. Check math on course to plot azimuth, reference azimuth and angle of intersection.

Count all county materials and complete the Office Summary Sheet when finished. Ensure that all materials are accounted for before they are sent to the state coordinator or field supervisor for editing.

1.0 PLOT LEVEL DATA

In general, plot level data apply to the entire plot. They are recorded from the center of subplot 1. If subplot 1 is not established, record from the lowest numbered subplot that is established.

ITEM 1010 STATE (CORE 1.1)

Record the unique FIPS code (Federal Information Processing Standard) identifying the State where the plot center is located.

When collected: All plots
Field width: 2 digits
Values:

01	Alabama	40	Oklahoma
05	Arkansas	45	South Carolina
12	Florida	47	Tennessee
13	Georgia	48	Texas
21	Kentucky	51	Virginia
22	Louisiana	72	Puerto Rico
28	Mississippi	78	US Virgin Islands
37	North Carolina		

ITEM R110 CYCLE

Record the number corresponding to the cycle in which current plot data is being collected.

When collected: All plots
Field width: 2 digits
Values: 01 to 99

ITEM R111 PANEL

Record the number identifying the unique panel to which each plot is assigned.

When collected: All plots
Field width: 1 digit
Values: 1 to 5

ITEM 1020 COUNTY (CORE 1.2)

Record the unique FIPS code identifying the county where the plot center is located.

When collected: All plots
Field width: 3 digits
Values: See Appendix 1

ITEM 1030 PLOT NUMBER (CORE 1.3)

Record the identification number for each plot, unique within a county.

When collected: All plots
Field width: 4 digits
Values:

Plot numbers in the south adhere to the following numbering system:

0001-0999	Standard field plots
4001-4999	Intensification plots (see Section 8.4)
9000-9999	Temporary and supplemental plots

ITEM R112 PHASE

Record the number identifying the phase under which plot data is being collected.

When collected: All standard field plots
Field width: 1 digit
Values:

2	Standard field plot (measured year-round)
3	Standard field plot with forest health variables (measured only during specified time frame)

ITEM 1200 P3 HEXAGON NUMBER (CORE 1.2)

Record the unique code assigned to each Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 7 digits

ITEM 1210 P3 PLOT NUMBER (CORE 1.2)

Record the P3 PLOT NUMBERS that are used to identify individual plots within the same Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 1 digit
Values: 1 to 9

ITEM 1040 SAMPLE KIND (CORE 1.4)

Record the code that describes the kind of plot being installed.
NOTE: If unable to locate a plot, contact the State FIA Coordinator (state employees) or the field coordinator (USFS employees).

When collected: All plots
Field width: 1 digit
Values:

1 **Initial plot establishment** - field-visited or remotely classified.

2 **Fixed plot remeasurement** - remeasurement of a previously established SRS **fixed radius** design plot or National design plot, field-visited or remotely classified.

3 **Replacement plot** - previously established SRS fixed radius design plot, prism point design plot, or National design plot that was replaced with a new plot because the original plot could not be relocated or plot data were lost.

9 **Prism plot remeasurement/Initial fixed plot establishment** – remeasurement of an established Southern or Southeastern Research Station **prism plot** design and initial establishment of the National design plot, field visited or remotely classified.

ITEM 1050 MANUAL VERSION

Record the version number of the National Core Field Guide that was used to collect the data on this plot. This will be used to match collected data to the proper version of the field manual.

When collected: All plots
Field width: 3 digits (x.yy)
Value: 1.61

ITEM 1060 CURRENT DATE (CORE 1.6)

Record the year, month, and day that the current plot visit was completed as follows:
Example: April 7, 2000 is coded 20000407

When collected: All plots
Field width: 8 digits
Values: yyyymmdd

ITEM R101 PAST DATE

Record the year, month, and day that the previous plot visit occurred. Past date can be obtained off the previous paper tally sheet.

When collected: SAMPLE KIND = 2 or 9
Field width: 8 digits
Values: Use same format as CURRENT DATE

ITEM 1160 QA STATUS (CORE 1.16)

Record the code to indicate the type of plot data collected.

When collected: All plots
Field width: 1 digit
Values:

1 Standard production plot (regular plot, no QA member present)
2 Cold check (QA reviews collected data while checking plot; may be done with or without standard field crew)
3 Reference plot (off grid- not an actual ground plot)
4 Training/practice plot (off grid- not an actual ground plot)
5 Botched plot file (disregard during data processing)
6 Blind check (QA crew remeasures the plot without reviewing the standard field crew's data; standard field crew is not present)
7 Production plot (hot check, QA member/s present during data collection)

ITEM 1170 CREW TYPE (CORE 1.17)

Record the code to specify what type of crew is measuring the plot.

When collected: All plots
Field width: 1 digit
Values:

1 Standard field crew
2 QA crew (at least one QA member is on the plot)

ITEM R102 CRUISER NUMBER

Record the unique code assigned to identify individual cruisers.

When collected: All plots
Field width: 3 digits
Values: 001-999

ITEM R103 NUMBER OF ACCESSIBLE FOREST LAND CONDITIONS

Record the number of accessible forest land conditions that are sampled on the plot.

When collected: All forested, partial, and landcleared plots
Field width: 1 digit
Values: 0-9

ITEM R104 NUMBER OF TREE ENTRIES

Record the total number of entries for the tree and sapling tally. This count includes entries to indicate no tally on a subplot or microplot.

When collected: All forested, partial, and landcleared plots
Field width: 3 digits
Values: 000-999

ITEM R109 NUMBER PRISM PLOTS REMEASURED/SUBPLOT CENTERS REVERTED

Record the number of prism plots remeasured on plots that were forested at the previous inventory. If plot center has reverted, then record the number of subplots that fall in a reverted condition. If both the present and the old past land uses at plot center are nonforest, then record 0.

When collected: All SAMPLE KIND = 9 forested, partial, and landcleared plots
Field width: 1 digit
Values: 0-5

If OLD LAND USE AT PLOT CENTER was forest: 1-5
(prism points remeasured)

If OLD PAST LAND USE AT PLOT CENTER is nonforest and PRESENT LAND USE is forest: 1-4
(subplot centers reverted)

If OLD PAST LAND USE and PRESENT LAND USE AT PLOT CENTER are both nonforest: 0

ITEM 1080 TRAILS OR ROADS (CORE 1.8)

Record the nearest trail or road within 1-mile horizontal distance of the plot center (subplot 1). Use the plot photo, maps, or reasonable observations made while traveling to the plot to determine nearest trail or road. If two or more trails or roads are estimated to be equally distant, code the better quality trail or road (lower code number). Base the coding decision on the condition of the road at the time of the visit.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0 None within 1 mile
1 Paved road or highway
2 Improved gravel road (has gravel, ditching, and/or other improvements)
3 Improved dirt road (has ditching, culverts, signs, reflectors, or other improvements)
4 Unimproved dirt road/four-wheel drive road (has no signs of any improvements)
5 Human access trail- clearly noticeable and primarily for recreational use

ITEM 1100 ROAD ACCESS (CORE 1.10)

Record the first road access restrictions encountered while traveling to the **starting point**. These restrictions limit car and truck access to the **starting point** for the walk to the plot, and may occur on ownerships encountered before reaching the plot area. If a route without restrictions to the starting point is available, record code 0.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0	None – no road access restrictions
1	Road blocked by locked gate or cable across road
2	Road blocked by a human-made obstruction across road (ditch, mound, etc.)
3	Road blocked by natural occurrences (trees blown over onto road, road or bridge washed out)
4	Posted no motorized vehicle signs; road present, but restricted area such as Wilderness or National Park where vehicles are not allowed
9	Other–specify in plot-level notes (e.g. owner makes you walk to SP)

ITEM 1110 PUBLIC USE RESTRICTIONS (CORE 1.11)

Record, if any, the restriction posted on the plot area that limits public use of the plot area; if more than one restriction occurs for the plot area, record the lowest number restriction present (1-3, 9). This item applies to the parcel(s) that the four subplots occupy, not access to the starting point.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0	None – no public use restrictions
1	Keep out / no trespassing
2	No hunting or fishing
3	No dumping
9	Other - specify in plot-level notes

ITEM 1120, 1130, 1140 RECREATION USE 1, 2, 3 (CORE 1.12, 1.13, 1.14)

Record up to 3 signs of recreation use encountered within the accessible forest land portion of any of the four subplots, based on evidence such as campfire rings, compacted areas (from tents), hiking trails, bullet or shotgun casings, tree stands, etc. Record the recreation use that has had the most significant impact on the plot area first, then the second and third use. For example, in general numerous four-wheel drive or ATV trails would be coded before camping, and camping before hiking, and hiking before fishing. Use the coding system provided as a hierarchy. Do not repeat codes, except codes 0 and 9. Physical recreation evidence must be present to code 1-9. Also, disregard dumping where no evidence of recreation is present. Examine the plot area for clues before spending an exorbitant amount of time trying to find evidence that normally would not be found in the area; look for the obvious signs first.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0	No evidence of recreation use
1	Motor vehicle (four wheel drive, ATV, motorcycle, snowmobile)
2	Horse riding, dog team trails, ski trails
3	Camping
4	Hiking
5	Hunting/shooting
6	Fishing
7	Boating – physical evidence such as launch sites or docks
9	Other – recreation use where evidence is present, such as human litter, but purpose is not clear or does not fit into above categories.

ITEM R105 HUMAN DEBRIS

Record the presence or absence of human debris on the forested portions of the 24 ft radius subplots. Do not code boundary paint and tree marking paint. If more than one category of debris is discovered on the plot, the record the lowest numbered item below.

This item codes debris type to assess dispersal characteristics and degree of permanence: materials that decay slowly, or rapidly, and light-weight materials that disperse farther from deposition areas. The item helps classify areas with and without human intrusions for scenic values and potential recreational experiences.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values: 0-3

0	None—No debris on the forested portion of the plot.
1	Noncombustible synthetic — includes glass, metal, aluminum beverage or food containers, discarded metal machinery, metal pesticide containers, metal fence, etc.
2	Combustible synthetics — includes plastics, styrofoam, tires, treated wood, nursery shade cloth, etc.
3	Combustible organic material from man-caused activities—includes yard waste, compost piles, livestock feed, wood debris from land clearing activity, slash from logging operations, etc.

ITEM 1150 WATER ON PLOT (CORE 1.15)

Record the water source that has the greatest impact on the area within the accessible forest land portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water. This variable may be used for recreation, wildlife, hydrology, and timber availability studies. This item is limited to water that is too small to qualify as non-census or census water. Census and non-census water are delineated as separate conditions on the plot.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0 None – no water sources
1 Permanent streams or ponds too small to qualify as non-census water
2 Permanent water in the form of deep swamps, bogs, marshes and is in a forest condition, or without standing trees present and is less than 1.0 ac in size.
3 Ditch/canal – human-made channels used as a means of moving water, such as irrigation or drainage which are too small to qualify as non-census water
4 Temporary streams
5 Flood zones – evidence of flooding when bodies of water exceed their natural banks
9 Other temporary water – specify in plot notes

ITEM 1090 HORIZONTAL DISTANCE TO IMPROVED ROAD (CORE 1.9)

Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements. Only examine the single photo that includes the plot pin-prick.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

1 100 ft or less
2 101 to 300 ft
3 301 to 500 ft
4 501 to 1000 ft
5 1001 ft to 1/2 mile
6 >1/2 to 1 mile
7 >1 to 3 miles
8 >3 to 5 miles
9 Greater than 5 miles

ITEM R106 HORIZONTAL DISTANCE TO URBAN OR BUILT-UP LAND

Record the straight-line distance from plot center (subplot 1) to the nearest evidence of urban or built-up land. Only examine the single photo that includes the plot pin-prick.

Urban or built-up land — Land that is 10 acres or more in size and comprised of areas of intensive human use with much of the land covered by manmade structures and associated clearings. Included are towns, villages, strip-developments along highways, power and communication facilities (excluding rights-of-way), industrial complexes, and institutions.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values: same as HORIZONTAL DISTANCE TO IMPROVED ROAD

Urban or built-up land is further defined as any 10-acre area (660 x 660 feet) composed of a mixture of land uses where urban or built-up land uses comprise more than 50 percent of the land area. Included are residential or commercial strips. Residential or commercial strips are at least 100 feet wide and 10 acres in size (4400 x 100, 2200 x 200, 1500 x 300, 1100 x 400, 900 x 500, etc.) with uniform spacing of structures, often with lawns, driveways, and parking lots.
Active surface mines, active sand and gravel pits, and other areas TEMPORARILY devoid of vegetation due to man's activities are NOT considered urban or built-up land. Similarly, naturally formed talus slopes and rock outcrops, mine tailings and soil pushed aside from surface mine operations, and bare soil associated with crop tillage are not urban or built-up land. Buildings, permanent product storage bins, and equipment parking areas are considered urban or built-up land.

The presence or absence of a store in a strip development has no bearing on this classification. Where a strip development consists of a mixture of farmsteads and residences, or farmsteads or other urban or built-up land, then consider farmsteads as built-up land. (Farmstead—a tract of land, usually with a house, barn, etc., on which crops or livestock are raised.) A farmstead is otherwise considered agricultural land.

ITEM R107 HORIZONTAL DISTANCE TO AGRICULTURAL LAND

Record the straight-line distance from the plot center (subplot 1) to the nearest evidence of agricultural land. Only examine the single photo that includes the plot pin-prick.

Agricultural Land — Land that is 10 acres or more in size and used primarily for the production of crops or livestock. Evidence includes geometric field and road patterns and the traces produced by livestock or mechanized equipment. Included are cropland, idle farmland, improved pasture, and other farmland (e.g., confined feeding areas, horse farms, farmsteads, nurseries, orchards, and vineyards).

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values: same as HORIZONTAL DISTANCE TO IMPROVED ROAD

ITEM R108 SIZE OF CONTIGUOUS FOREST LAND

Record the category below that indicates the size of the contiguous forest land around plot center (subplot 1). Only examine the single photo that includes the plot pin-prick to determine the size of the contiguous forest. If plot center is nonforest, then record 0.

Contiguous Forest Land — Forested areas that are at least 120 feet wide and 1.0 ac in size. Boundaries are nonforest areas that are at least 120 feet wide. Right-of-ways (e.g., power lines, pipe lines, woods roads, improved roads) are not boundaries unless the cleared area between the trees is at least 120 feet wide.

When collected: ACCESSIBLE FOREST LAND CONDITIONS > 0
Field width: 1 digit
Values:

0	Plot center is non-forest
1	1 – 10 acres
2	11 – 50 acres
3	51 – 100 acres
4	101 – 500 acres
5	501 - 2,500 acres
6	2,501 – 5000 acres
7	> 5,000 acres

GPS COORDINATES

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field visited plot locations. Coordinates are not required on any intensification plots.

COLLECTING READINGS

Collect at least 180 GPS readings at the plot center. Each individual position should have an error of less than 70 ft if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error ≤ 70 ft) cannot be obtained, try again before leaving the plot center.

CORRECTION FOR "OFFSET" LOCATION

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 ft of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. If a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in ITEMS 1812 and 1813.

Coordinates may be collected further than 200 ft away from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Again, if a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in ITEMS 1812 and 1813.

In all cases try to obtain at least 180 positions before recording the coordinates.

ITEM 1803 GPS UNIT (CORE 1.18.3)

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

When collected: All field visited plots
Field width: 1 digit
Values:

0 GPS coordinates not collected
1 Rockwell Precision Lightweight GPS Receiver (PLGR)
2 Other brand capable of field averaging
3 Trimble GeoExplorer or Pathfinder Pro
4 Recreational GPS (Garmin, Magellan, etc.)

ITEM 1804 GPS SERIAL NUMBER (CORE 1.18.4)

Record the last six digits of the serial number on the GPS unit used.

When collected: GPS UNIT > 0
Field width: 6 digits
Values: 000001 to 999999

ITEM 1806 LATITUDE (CORE 1.18.6)

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS. Record the latitude of the off-set point if the coordinates cannot be calculated.

When collected: GPS UNIT > 0
Field width: 8 digits (DDMMSSSS)
Values: Dependent on location (see Appendix 1)

ITEM 1807 LONGITUDE (CORE 1.18.7)

Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS. Record the longitude of the off-set point if the coordinates cannot be calculated.

When collected: GPS UNIT > 0
Field width: 9 digits: (DDDMMSSSS)
Values: Dependent on location (see Appendix 1)

ITEM 1814 GPS ELEVATION (CORE 1.18.14)

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS. Record the elevation of the off-set point if the coordinates cannot be calculated.

When collected: GPS UNIT > 0
Field width: 6 digits
Values: -00100 to +20000

ITEM 1815 GPS ERROR (CORE 1.18.15)

Record the error as shown on the GPS unit to the nearest foot. Make every effort to collect readings only when the error ≤ 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record reading with an error of up to 999 ft.

When collected: GPS UNIT = 1 or 2
Field width: 3 digits
Values:
000 to 070 if possible
071 to 999 if an error of less than 70 ft cannot be obtained

ITEM 1816 NUMBER OF READINGS (CORE 1.18.16)

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: GPS UNIT = 1 or 2
Field width: 3 digits
Values: 001 to 999

ITEM 1812 AZIMUTH TO PLOT CENTER (CORE 1.18.12)

Record the azimuth from the location where coordinates are collected to actual plot center. If coordinates are collected at, or corrected to, plot center, record 000.

When collected: GPS UNIT = 2, 3 or 4
Field width: 3 digits
Values: 000 when collected coordinates represent plot center
001 to 360 when collected coordinates represent an off-set point

ITEM 1813 DISTANCE TO PLOT CENTER (CORE 1.18.13)

Record the horizontal distance in feet from the location where coordinates are collected to the actual plot center. If coordinates are collected at, or corrected to, plot center, record 000. If a Laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 ft from the plot center. If a range finder is not used, the offset location must be within 200 ft.

When collected: When collected: When GPS UNIT = 2, 3 or 4
Field width: 3 digits
Values:

000 when collected coordinates represent plot center
001 to 200 when collected coordinates represent an off-set point and a Laser range finder is **not** used to determine distance
001 to 999 when collected coordinates represent an off-set point and a Laser range finder **is** used to determine distance

ITEM 1190 PLOT-LEVEL NOTES (CORE 1.19)

Use these fields to record notes pertaining to the entire plot. If the notes apply only to a specific subplot or other specific aspect of the plot, then make that clear in the notes.

When collected: All plots
Field width: Unlimited alphanumeric character field
Values: English language words, phrases and numbers

2.0 CONDITION CLASS

The Forest Inventory and Analysis (FIA) plot is a cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1). Delineation and mapping of condition classes is a major departure from past inventory practices, and is intended to allow flexible post stratification of data for a variety of purposes.

2.1 DETERMINATION OF CONDITION CLASS

2.1.1 Step 1: Delineate the plot area by CONDITION STATUS

The first attribute considered when defining a condition class is CONDITION STATUS. The area sampled by a plot is assigned into condition classes based upon the following differences in CONDITION STATUS:

1. Accessible forest land
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit
7. Area that is not in the sample, e.g., in Canada or Mexico.
9. Lost subplot (Sample Kind = 2, forest conditions only)

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted. Only delineate between conditions 2-7 above on subplots that have at least one accessible forest land condition. Do **not** delineate between nonforest conditions 2-7 above on completely nonforest subplots.

2.1.2 Step 2: Further subdivide Accessible Forest land by 7 delineation variables

Any condition class sampled as accessible forest land may be further subdivided, in order of listed priority, into smaller condition classes if distinct, contrasting condition classes are present because of variation within the sampled area in any of the following attributes:

1. New Past Condition Status (ITEM R202, reversions/landclearings)
2. Reserved Status (ITEM 2401)
3. Owner Group (ITEM 2402)
4. Forest Type (ITEM 2403)
5. Stand Size Class (ITEM 2404)
6. Regeneration Status (ITEM 2405)
7. Tree Density (ITEM 2406)

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For most accessible forest condition classes recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes.

2.1.3 Step 3: Subdivide Nonforest Land conditions

Delineate between conditions 2-7 in 2.1.1 on subplots that have at least one accessible forest land condition. Do **not** delineate between conditions 2-7 in 2.1.1 on completely nonforest subplots. Nonforest land (code 2 in 2.1.1) is recorded as one condition, with the following exceptions:

1. Land cleared areas: Nonforest areas that have been landcleared since the last inventory are separated from other nonforest conditions that were nonforest at the previous survey.

2. Procedural changes: Nonforest areas that are reclassified to forest due to procedural changes are separated from other conditions on the plot.

These exceptions are recorded as separate nonforest conditions in order to capture the amount of real and procedural change between surveys.

2.2 CONDITION CLASS ATTRIBUTE LIST

Condition Class Number	=	
Present Land Use	=	Required Attributes-
Present Condition Status	=	Attributes required for every
New Past Land Use	=	condition class sampled on a plot
New Past Condition Status	=	
Old Land Use	=	
Nonforest Year	=	Required on landclearings only
Similar Identified Condition	=	Required on reversions and landclearings only

For each condition classified as accessible forest land, then a classification is required for each of the following attributes:

Reserved Status	=	
Owner Group	=	Condition Defining Attributes-
Present Forest Type	=	Attributes where a change
Stand Size	=	causes a separate within forest
Present Regeneration Status	=	condition class
Tree Density	=	
New Past Forest Type	=	Attributes that describe change
New Past Regeneration Status	=	between inventories
Owner Class	=	
Private Owner Industrial Status	=	
Artificial Regeneration Species	=	
Stand age	=	National Ancillary Attributes-
Disturbance	=	Changes do not delineate a
Disturbance Year	=	new condition class.
Treatment	=	
Treatment Year	=	
Physiographic Class	=	

Tract Size (Total Acres)	=	
Tract Size (Percent forest)	=	
Site Class	=	Regional Ancillary Attributes-
Stand Structure	=	Changes do not delineate a
Operability	=	new condition class.
Distance to Water Source	=	
Water Source	=	
Fire	=	
Grazing	=	

When classifying condition status, land use, reserved status, owner group, fire, and grazing, base the classification on what is present within the area defined by the 24 ft fixed radius subplot. When classifying all other condition class variables, base the classification on the 58.9 ft fixed radius annular plot.

2.3 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION STATUS:

The first step in delineating condition classes is to recognize differences in CONDITION STATUS. The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 1.0 ac in size, and each is at least 120.0 ft in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 ac in size and less than 120.0 ft in width are considered forest land and are not delineated and classified as a separate nonforest condition class.

Within a nonforest land condition class, forested areas or linear strips of trees less than 1.0 ac in size and less than 120.0 ft in width are considered part of the nonforest condition class.

Five exceptions to these size and width requirements apply:

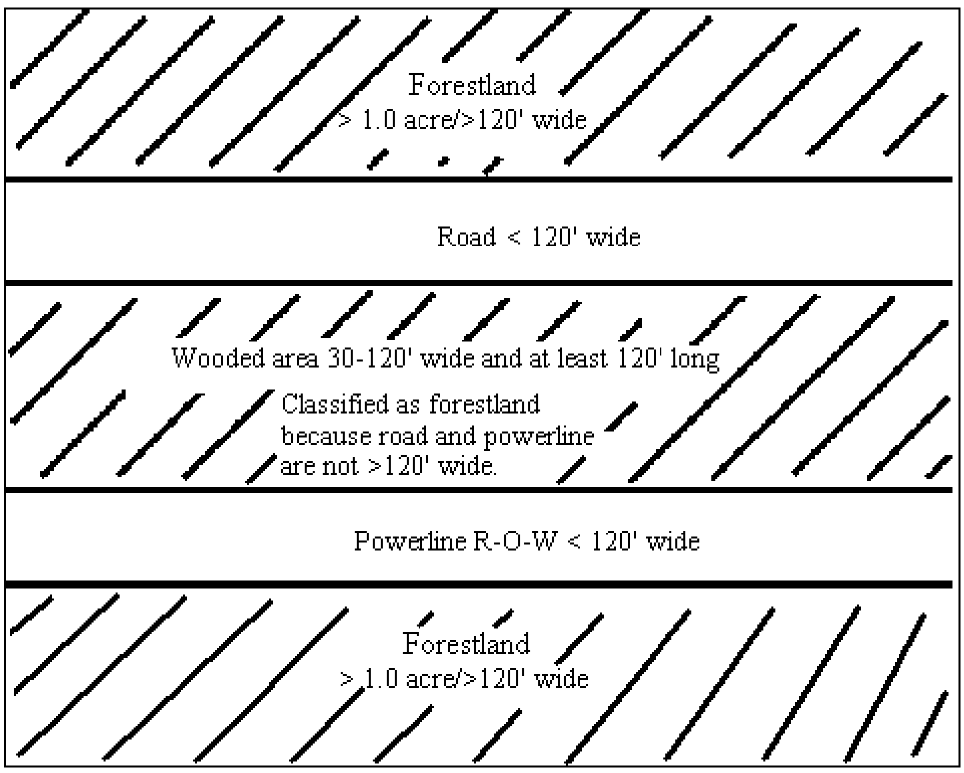
1. Developed nonforest conditions: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 ac in size and 120.0 ft in width and are surrounded by forest land. All extensions from developed nonforest inclusions are nonforest condition classes regardless of length or width. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements.

    a) Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. Unimproved traces and roads created for skidding logs are not considered improved roads.

    b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs.

c) Developments: structures and the maintained area next to a structure, all less than 1.0 ac in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds.

However, these areas must still be at least 120.0 ft wide to stop a forest land condition from continuing across the nonforest entity. The boundaries of forested areas are nonforest areas 120.0 feet or greater. Developed nonforest entities less than 120 feet wide or 1.0 ac are not forest boundaries, even though they are delineated as nonforest conditions. See diagram below:

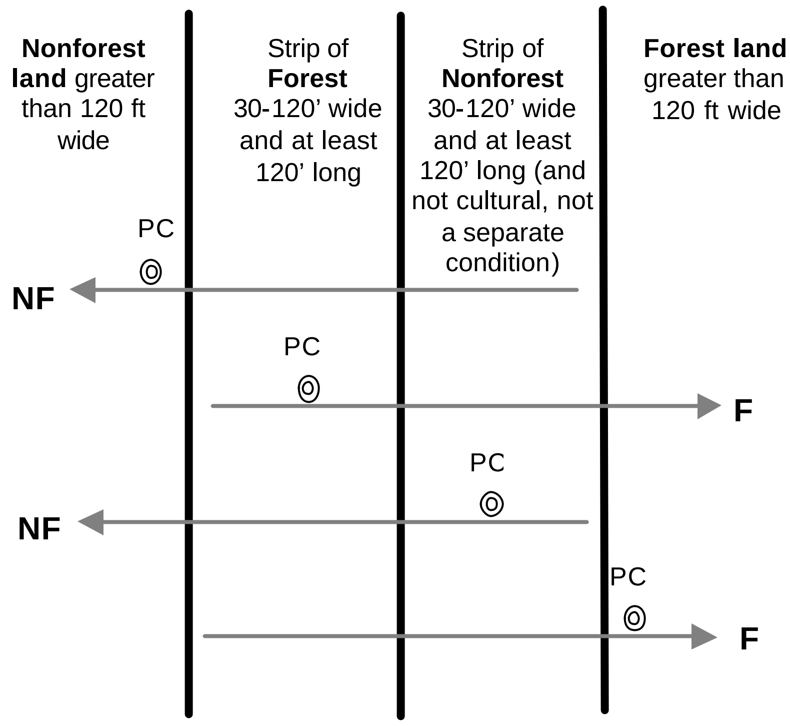


2. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is at least 30.0 ft wide and at least 120.0 ft in length. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement. If the strip of land is less than 30.0 feet wide, or less than 120.0 ft in length, then it is included with the surrounding land use.

   For many small intermingled strips, determine the total area that the alternating strips occupy, and classify according to the CONDITION STATUS (forest land or nonforest land) that occupies the greater area. If the area of alternating strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.

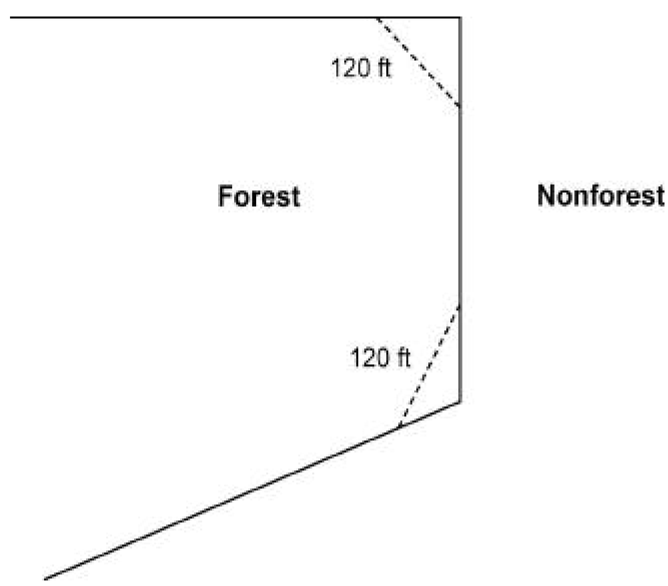
   For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 2. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.

Figure 2. Example of alternating strips of forested and non-forested conditions.



3. The 120 foot minimum width for determining forest boundaries does not apply when a corner angle is 90 degrees or greater (Figure 3).

Figure 3. Illustration of the 90-degree corner rule. The triangle shaped wedges are forest, regardless of where the subplot center lands.



4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 ft wide and cover at least 1.0 ac. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features which do not meet the definition for Census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 ac requirement; use professional judgment and common sense on any linear water feature.

5. Hazardous, denied access, and lost subplots within accessible forest land are delineated, regardless of size, as a separate condition.

2.3.1 ACCESSIBLE FOREST LAND

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets (a) **and** (b) from the following criteria:

(a) the condition is at least 10-percent stocked by trees of any size (Appendix 2) or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities;

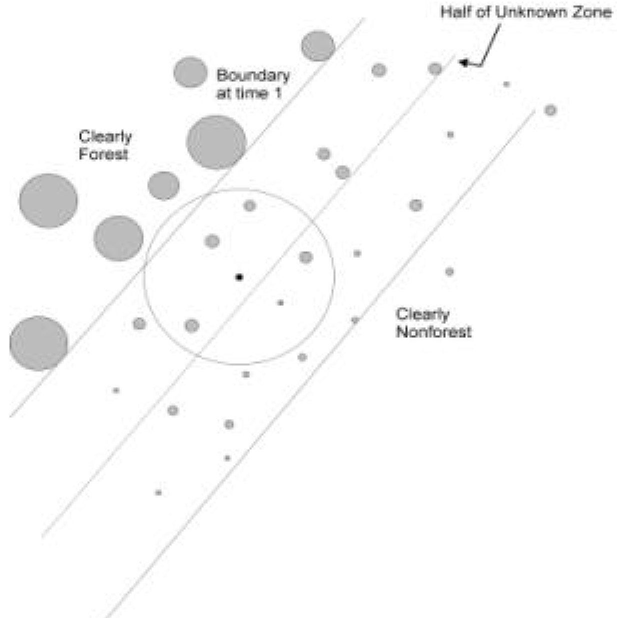
and

(b) the prospective condition must be at least 1.0 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

Transition zones and forest/nonforest encroachment: When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10% minimum forest land stocking, and where it clearly is less than required stocking; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 4).

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment is clearly stocked where it meets the nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone is not clearly stocked where it meets the nonforest, determine where it is clearly stocked (forest) and where it is clearly not stocked (nonforest); divide this zone in half, and classify the entire unknown zone based on which side of the line the subplot center falls.

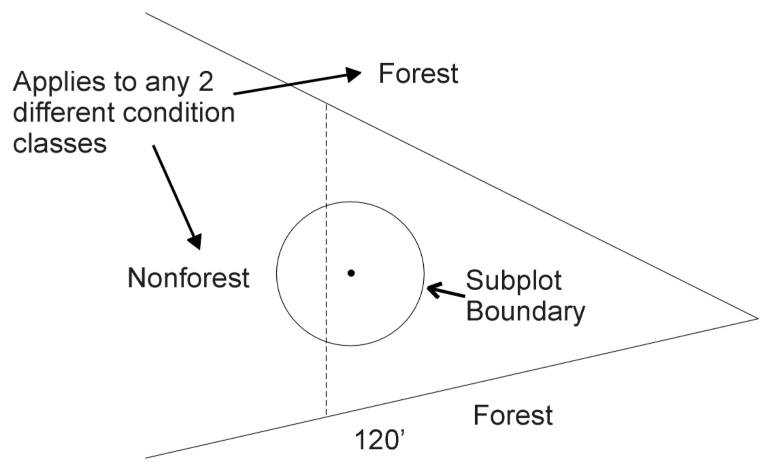
Figure 4. Example of classifying the condition class of a subplot in a transition zone with forest/nonforest encroachment.



Treated strips: Occasionally, crews will come across plantations of trees, in which rows of trees alternate with strips of vegetation that have been bulldozed, mowed, tilled, treated with herbicide, or crushed. Because these strip treatments are conducted to optimize growth or to release the stand, the areas are considered forest land, and the treatment is considered a timber stand improvement operation. Do not confuse these practices with similar treatments on nonforest lands such as yards or rights-of-way. Contact with the landowner may help determine the intent of a treatment.

Indistinct boundary due to the minimum-width definition: Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 ft) definition. Although the point where the definition changes from forest to nonforest creates an invisible "line" between conditions, **this definitional boundary is not distinct and obvious**. See Figure 5. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.

Figure 5. Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120 ft wide. In this example, the entire subplot is classified as forest.



2.3.2 NONFOREST LAND

Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the CONDITION STATUS values defined in Sections 2.3.3 through 2.3.7. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, with 5 exceptions discussed previously at the beginning of section 2.3. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next occasion to see if it has become forest land.

2.3.3 NONCENSUS WATER

Lakes, reservoirs, ponds, and similar bodies of water 1.0 ac to 4.5 ac in size. Rivers, streams, canals, etc., 30.0 ft to 200 ft wide.

2.3.4 CENSUS WATER

Lakes, reservoirs, ponds, and similar bodies of water 4.5 ac in size and larger; and rivers, streams, canals, etc., more than 200 ft wide (1990 U.S. Census definition).

2.3.5 DENIED ACCESS

Any area within the sampled area on a plot on which access is denied by the legal owner of the land the plot falls on, or by an owner of the only reasonable route to the plot. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.

2.3.6 HAZARDOUS

Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.

2.3.7 NOT IN THE SAMPLE

Any area within the sampled area on a plot that is not within the boundaries of the sample population of interest. Examples of areas out of the sample would be plots or portions of plots falling in Mexico or Canada. A condition outside the sample area remains in the potential population of interest and is re-examined at the next occasion to determine if it becomes part of the population of interest. There are no minimum size or width requirements for a condition class delineated as out of the sample.

2.4 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND

2.4.1 DELINEATING BASED ON THE SIX CONDITION DEFINING ATTRIBUTES

Accessible forest land is subdivided into condition classes that are based on differences in RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY. Section 2.1 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented in ITEMS 2401-2406. “Stands” are defined by plurality of stocking for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 ac in size and at least 120.0 ft in width, except riparian forest areas (see general instruction 4 below). If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained.

No other attribute shall be the basis for recognizing contrasting condition classes. For each condition class recognized, there are many “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see ITEMS 2407-2423 and ITEMS 201R-219R).

2.4.2 DELINEATING WITHIN FOREST CONDITION CLASSES BASED ON NEW PAST CONDITION STATUS

Accessible forest land is also subdivided into several categories based on the history of the CONDITION STATUS. These divisions break out reverted, landcleared, and lost conditions from all other identified conditions on the plot, regardless of the present similarities between them. These conditions are EXEMPT from the within forest size requirements of 120 ft wide and 1.0 ac and are described below in General Instructions #5-7.

2.4.3 GENERAL INSTRUCTIONS FOR DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LANDS:

1. Distinct boundary within a subplot, or microplot: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 3.0.

2. Indistinct boundary within a subplot: Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

    Example: The 4 subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large diameter trees. Subplot 2 falls in the middle of a stand size transition zone. In the zone, the large diameter stand phases into a sapling stand. Subplot 2 must not be divided into two condition classes on the basis of stand size. Instead, it is treated entirely as part of the large diameter condition class or is assigned entirely to a new condition class that is classified as a seedling-sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedling-saplings than a stand of large diameter trees; then the boundary between the large and small diameter stands is assumed to occur between and not on the subplots.

3. A boundary or transition zone between fixed radii plots that sample distinctly different condition classes: Separate condition classes ARE recognized and recorded when a valid attribute obviously differs between two fixed radius plots, but a distinct boundary or indistinct transition zone exists outside the sampled (fixed-radius) area of the subplots. In such cases, a boundary, if present, is not referenced.

    Example: The northernmost subplot (2) samples a pure hardwood forest type. The other three subplots, 1, 3, and 4, fall clearly in a pure pine stand. Between subplot 1 and 2 is a transition zone; the number of hardwood trees present goes from none to what clearly represents at least 75-percent of the stocking. Two condition classes are sampled: hardwood sampled on subplot 2, and pine sampled on the other subplots.

4. Riparian forest area: A riparian forest area is defined as a forest area between 30 and 120 ft wide, and 1.0 ac or more in size, cumulative, but not necessarily present on both sides of and adjacent to a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated “within forest” and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class.

   Note: When the width of forest adjacent to a stream is between 120.0 ft and 150.0 ft and the width of the riparian forest is at least 30.0 ft wide, the rules for identifying the non-riparian forest (at least 30.0 ft but less than 120.0 ft) need to be modified. The non-riparian forest can be between 30.0 ft and 120.0 ft and mapped as a separate condition as long as it meets the criteria for delineating a separate condition class, otherwise it will be an inclusion in the riparian forest condition class.

5. Reverted forest area: Forest areas that have reverted since the last inventory are separated from conditions that were accessible forest land at the previous inventory.

6. Procedural changes: Forest areas that must be reclassified due to procedural changes are separated from other conditions on the plot.

7. Lost data: Forest areas that cannot be remeasured due to lost data (i.e., subplot could not be relocated) are delineated from other conditions. This distinction is only made on SAMPLE KIND = 2 plots. Record PRESENT CONDITION STATUS = 9.

2.5 DETERMINING CONDITION CLASSES WITHIN NONFOREST LAND

All nonforest land conditions are recorded as one condition, with the following exceptions:

1. Land cleared areas: Nonforest areas that have been landcleared since the last inventory are separated from other nonforest conditions that were nonforest at the previous survey.

2. Procedural changes: Nonforest areas that are reclassified from forest land to nonforest land due to procedural changes are separated from other conditions on the plot.

These exceptions are recorded as separate nonforest conditions in order to capture the amount of real change between surveys as well as to quantify change due to variance in field procedures.

2.6 RECORDING CONDITION LEVEL CHANGES BETWEEN INVENTORIES

2.6.1 NEW PAST LAND USE

Recorded on all Sample Kinds. A new past attribute is recorded that identifies how the LAND USE has changed since the last survey. When determining the value of the "new" past land use, record a code that best describes what the past land use would have been if all CURRENT procedures had been in use at the time of the previous inventory of the four subplots. Always use the current codes; never use the old codes. Use all the information at your disposal to determine the "new" past land use (i.e., past photos, crew notes, diagrams, and even the previous cruiser call). But keep in mind the previous cruiser was using different procedures. To record a different past code than the previous cruiser, it MUST BE CLEARLY OBVIOUS that the attribute would have been different using current procedures, or that the previous cruiser was in error.

2.6.1 OLD LAND USE

Recorded on Sample Kind 2 and 9 plots only. Record the code that matches the land use that the previous cruiser recorded for the condition. Use the current codes; do not use the old codes. For example, the previous code for a road was 67. Record land use code 32.

2.6.3 SIMILAR IDENTIFIED CONDITION CLASS

Recorded on reverted and landcleared conditions on SK 2 remeasurement plots only. Since NEW PAST CONDITION STATUS can delineate a condition in addition to the six condition defining attributes, two conditions may be appear to be identical at the current inventory, yet must remain separate conditions because they have a different past condition status. This is done to capture the amount of change (e.g., reversions and landclearings) between surveys.

NOTE: Conditions that are less than 120.0 ft wide or less than 1.0 ac in size should be broken out to delineate reverted areas, areas reclassified due to procedural changes, or to identify conditions that cannot be remeasured due to lost data (see Section 2.4.2).

If it were not for any of the above, many reverted and landcleared conditions would actually be a part of another condition on the plot. SIMILAR IDENTIFIED CONDITION is an attribute that links these types of conditions together. On reverted conditions it is simply a shortcut so the cruiser does not have to record the forest descriptor data twice. The reverted forest condition either exactly matches another forest condition on the plot or it otherwise would not stand alone if it were not a reverted condition. Landcleared conditions require SIMILAR IDENTIFIED CONDITION to link it to any other nonforest conditions on the plot. When the plot is remeasured in the future, the condition data will be linked so that the next crew only sees one condition record. See examples on next page.

Example 1:

At the last survey, the plot had two conditions. Condition 1 was accessible forest land and Condition 2 was idle farm land. Since then, the forest land has been clearcut, and both it and the nonforest land were planted in loblolly pine. At the present survey, the plot still has two conditions – a forest to forest condition (labeled Condition 1), and a reverted condition (labeled Condition 2). However, since both conditions do not differ in any of the six condition defining attributes, they would be one condition if one or them were not reverted. In this example, SIMILAR IDENTIFIED CONDITION is coded '1' for the reverted condition. The remaining forest descriptor attributes are not required for the reverted condition because the crew has indicated that the forest condition variables are the same as condition 1. At the next survey, only the condition record for condition 1 will be sent to the field.

CONDITION LEVEL DATA																				
ALL CONDITIONS								FOREST CONDITIONS ONLY (and R201 = 0)												
	CONDITION STATUS							RES RVD	OWNERSHIP					FOREST TYPE		SIZE	REGENERATION STATUS			DEN SITY
CONDITION CLASS NUMBER	PRESENT LAND USE	PRESENT CONDITION STATUS	NEW PAST LAND USE	NEW PAST CONDITION STATUS	OLD LAND USE (SK 2 & 9)	NON-FOREST YEAR (SK 2 & 9)	SIMILAR IDENTIFIED CONDITION	RESERVED STATUS	OWNER CLASS	OWNER GROUP	PRIVATE OWNER INDUSTRIAL STATUS	TRACT SIZE (TOTAL ACRES)	TRACT SIZE (PERCENT FOREST)	PRESENT FOREST TYPE	NEW PAST FOREST TYPE	STAND SIZE CLASS	PRESENT REGENERATION STATUS	NEW PAST REGENERATION STATUS	ARTIFICIAL REGENERATION SPECIES	TREE DENSITY
2201	2425	2202	2424	R202	R219	2426	R201	2401	2407	2402	2408	R205	R206	2403	R207	2404	2405	R209	2409	2406
X	XX	X	XX	X	XX	XXXX	X	X	XX	XX	X	XXXXX	XXX	XXX	XXX	X	X	X	XXX	X
1	01	1	01	1	01	---	---	0	45	40	0	00200	094	161	161	1	1	0	131	0
2	01	1	13	2	13	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---

Example 2:

At the last survey, the plot had two conditions. Condition 1 was pasture and Condition 2 was a medium size pine plantation. Since then, the pasture has been abandoned. The field crew determines that a 50-foot strip along the edge of the pine plantation has reverted (see Section 2.3.1). The reverted strip is delineated as a new separate condition (labeled Condition 1 by the current crew) from the pine plantation (labeled Condition 2) and from the pasture (labeled Condition 3). This will provide an estimate on how much land area is reverted. However, since the reverted strip is less than 120.0 ft wide, it conflicts with the size requirement for a forest condition. Since it normally would not stand on its own as a separate condition, SIMILAR IDENTIFIED CONDITION for the reverted strip is recorded '2' to link it with the pine plantation condition.

CONDITION LEV EL DATA																				
ALL CONDITIONS								FOREST CONDITIONS ONLY (and R201 = 0)												
	CONDITION STATUS							RES RVD	OWNERSHIP					FOREST TYPE		SIZE	REGENERATION STATUS			DEN SITY
CONDITION CLASS NUMBER	PRESENT LAND USE	PRESENT CONDITION SATAUS	NEW PAST LAND USE	NEW PAST CONDITION STATUS	OLD LAND USE (SK2 & 9)	NON-FOREST YEAR (SK2 & 9)	SIMILAR IDENTIFIED CONDITION	RESERVED STATUS	OWNER CLASS	OWNER GROUP	PRIVATE OWNER INDUSTRIAL STATUS	TRACT SIZE (TOTAL ACRES)	TRACT SIZE (PERCENT FOREST)	PRESENT FOREST TYPE	NEW PAST FOREST TYPE	STAND SIZE CLASS	PRESENT REGERATION STATUS	NEW PAST REGENERATION STATUS	ARTIFICIAL REGENERATION SPECIES	TREE DENSITY
2201	2425	2202	2424	R202	R219	2426	R201	2401	2407	2402	2408	R205	R206	2403	R207	2404	2405	R209	2409	2406
X	XX	X	XX	X	XX	XXXX	X	X	XX	XX	X	XXXXX	XXX	XXX	XXX	X	X	X	XXX	X
1	01	1	12	2	12	---	2	---	---	---	---	---	---	---	---	---	---	---	---	---
2	01	1	01	1	01	---	---	0	45	40	0	00525	080	161	161	2	1	1	131	0
3	12	2	12	2	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

2.7 CONDITION LEVEL ATTRIBUTE CLASSIFICATION

ITEM 2201 CONDITION CLASS NUMBER (CORE 2.2.1)

On a plot, assign and record a unique identifying number for each condition class. At the time of the plot establishment, the condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated. On a plot, each sampled condition class must have a unique number that can change at remeasurement to reflect new conditions on the plot.

When collected: All condition classes
Field width: 1 digit
Values: 1 to 9

ITEM 2425 PRESENT LAND USE (CORE 2.4.25)

Record the classification that indicates the land use of the condition.

This code may not necessarily mirror the condition status code. For example, the PRESENT CONDITION STATUS of a forested area may be coded denied access (ITEM 2202, code 5). However, if the area is easily visible, the correct land use can be identified without physically occupying the denied access area. Use code 03 when the plot samples forest land but is not accessible for data collection. Use codes 10, 30, 40 and 90 only for land not better described by one of the more detailed codes within each category. See glossary for complete definitions.

When collected: All condition classes
Field width: 2 digits
Values:

01	Accessible timber land
02	Accessible other forest land
03	Denied access forest land
04	Hazardous forest land
08	Lost subplot (timber land)
09	Lost subplot (other forest)
10	Other agricultural land
11	Cropland
12	Pasture (improved)
13	Idle farmland
14	Orchard
15	Christmas tree plantation
16	Maintained wildlife openings
20	Rangeland
30	Other developed
31	Cultural (business, residential, etc.)
32	Rights-of-way (road, railroad, utility line)
33	Recreation area (golf course, campground, parks, etc.)
34	Mining
40	Other non-forest (barren land, rock)
41	Non-census water
42	Marsh
43	Beaches
91	Census water
92	Denied access – land use not classified
93	Hazardous – land use not classified
94	Area not in the sample (Mexico)

ITEM 2202 PRESENT CONDITION STATUS (CORE 2.2.2)

Record the code that describes the status of the condition. Record for all condition classes sampled on a plot. The instructions in Section 2.2 and 2.3 apply when delineating condition classes that differ by CONDITION STATUS.

When collected: All condition classes
Field width: 1 digit
Values:

1 Accessible forest land
2 Nonforest land
3 Noncensus water
4 Census water
5 Denied access area
6 Area too hazardous to visit
7 Area that is not in the sample, e.g., in Canada or Mexico
9 Lost subplot (accessible forest land only)

ITEM 2424 NEW PAST LAND USE (CORE 2.4.24)

Record the code that best describes the past land use of the condition **if the current procedures had been used at the previous inventory**. Use previous cruiser sketch maps, old photos, and all relevant information when determining the past condition status. Only differ with the previous land use if it is OBVIOUS that it would have been different if the current procedures had been used, or that the previous cruiser was in error. Record a description in the PLOT LEVEL NOTES when the past land use is wrong or is different due to procedural changes.

When collected: All condition classes
Field width: 2 digits
Values: Use same codes for PRESENT LAND USE listed above

ITEM R202 NEW PAST CONDITION STATUS

Record the code that best describes the past status of the condition **if the current procedures had been used at the previous inventory**. Use previous cruiser sketch maps, old photos, and all relevant information when determining the past condition status. Only differ with the previous condition status if it is OBVIOUS that it would have been different if the current procedures had been used, or that the previous cruiser was in error.

When collected: All condition classes
Field width: 1 digit
Values: 1-7

ITEM R219 OLD LAND USE

Record the code that matches the land use that the previous cruiser recorded for the condition. Use the current codes; do not use the old codes. For example, the previous code for a road was 67. Record land use code 32.

When collected: SAMPLE KIND 2 all conditions;
SAMPLE KIND 9 condition 1 only
Field width: 2 digits
Values: Use same codes for PRESENT LAND USE listed above

ITEM 2426 NON-FOREST YEAR (CORE 2.4.26)

Record the estimated year that a previously accessible forest land condition class was converted to a non-forest condition. This variable will be used to apportion tree growth on any trees that were included in the condition when it was forest land. Record the year in which the conversion took place. In most cases, all trees in a given condition class will be assigned the same non-forest year. If it can be determined that a tree died before the land was converted to a non-forest use, mortality year is required at the tree level. If a previously accessible forest land condition is now nonforest due to procedural changes, then code the year of the previous survey.

When collected: SAMPLE KIND = 2, PAST CONDITION STATUS = 1, and PRESENT CONDITION STATUS not equal to 1;
SAMPLE KIND 9 condition 1 only, PAST CONDITION STATUS = 1, and PRESENT CONDITION STATUS not equal to 1
Field width: 4 digits
Values: 19xx or 200x, cannot precede year of previous inventory

ITEM R201 SIMILAR IDENTIFIED CONDITION CLASS NUMBER

Record only on reverted and landcleared condition classes on SAMPLE KIND 2 plots. If the condition is not at least 120.0 ft wide or at least 1.0 ac in size, list the condition number that it most likely would be combined with to meet the size requirements if it were not a landclearing or reversion. Follow instructions in Section 2.6.3

If any of the six condition defining variables are different from the other conditions on the plot, AND the condition meets size requirements so that it would remain a separate condition regardless, then code 0.

This is required simply so that the cruiser does not have to repeat the same forest descriptor variables for a reverted area that is broken out but is not large enough to stand on its own otherwise, or is exactly like another forest condition on the plot. It also will be used to link the data so next survey there is only one condition record sent to the field instead of two.

When collected: SAMPLE KIND 2, reverted and landcleared conditions only
Field width: 1 digit
Values: 0 to 9

ITEM 2401 RESERVED STATUS (CORE 2.4.1)

Record the code that identifies the reserved designation for the condition. Reserved land is withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood harvesting methods). Such authority is vested in a public agency or department, and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but rather is permanent in nature. The phrase "withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products. Examples of reserved land include: National Parks, Wilderness Areas, Wild and Scenic Rivers, Military Parks, etc.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0 Not reserved
1 Reserved

ITEM 2407 OWNER CLASS (CORE 2.4.7)

Record the OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. If multiple owner classes within a group occur on a single condition class, record the owner class closest to the plot center. Conditions will **NOT** be delineated based on changes in OWNER CLASS. Conditions will be delineated based on changes in OWNER GROUP that can be clearly identified on the ground when visiting the plot.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 2 digits
Values:

Owner Classes within US Forest Service Land (Owner Group 10)

11 National Forest
12 National Grassland
13 Other Forest Service

Owner Classes within Other Federal Land (Owner Group 20)

21 National Park Service
22 Bureau of Land Management
23 Fish and Wildlife Service
24 Departments of Defense/Energy
25 Other Federal

Owner Classes within State and Local Government Land (Owner Group30)

31 State
32 Local (County, Municipality, etc.)
33 Other Non Federal Public

Owner Classes within Private Land (Owner Group 40)

- 41 Corporate
- 42 Non Governmental Conservation / Natural Resources Organization
  Examples: Nature Conservancy, National Trust for Private Lands, Pacific Forest Trust, Boy Scouts of America, etc.
- 43 Unincorporated Partnerships / Associations / Clubs
  Examples: Hunting Clubs that **own, not lease** property, recreation associations, 4H, etc.
- 44 Native American (Indian) within reservation boundaries
- 45 Individual

ITEM 2402 OWNER GROUP (CORE 2.4.2)

Record the OWNER GROUP code identifying the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will be delineated based on changes in OWNER GROUP only; separate conditions due to changes in OWNER GROUP are recognized only where the differences can be clearly identified on the ground when visiting the plot.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 2 digits
Values:

- 10 US Forest Service
- 20 Other Federal
- 30 State and Local Government
- 40 Private

ITEM 2408 PRIVATE OWNER INDUSTRIAL STATUS (CORE 2.4.8)

Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, “mom & pop” home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner’s industrial status due to name, commercial plant size, type plant, etc., choose code 0 below.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0, PRESENT CONDITION STATUS = 1, and OWNER GROUP = 40
Field width: 1 digit
Values:

- 0 Land **is not** owned by industrial owner with a wood processing plant
- 1 Land **is** owned by industrial owner with wood processing plant

ITEM R205 TRACT SIZE (TOTAL ACRES)

Tract size is recorded when the OWNER GROUP is 40 **and** the PRIVATE OWNER INDUSTRIAL STATUS is 0. Include both forest and non-forest acres of the parcel. Do not include separate parcels that the landowner may own elsewhere. If more than one private landowner owns a sample location, record the tract size information for the first forest condition for subsequent forest conditions classified as a private, non-industrial landowner, even though they may be a different owner. See Ownership Procedures in Section 0.3.

Tract size often affects whether a forest stand is likely to be managed and the likelihood of its becoming a source of timber supplies. Very small parcels of land in primarily urban settings are often perceived to be unavailable for timber harvest and many users of FIA data have requested that these areas be identified to eliminate them from the resource base when assessing timber availability. Tract size also provides the ability to track timber removals for parcels of different sizes over time.

When collected: SIMILAR IDENTIFIED CONDITION CLASS NUMBER = 0, PRESENT CONDITION STATUS = 1, OWNER GROUP = 40, and PRIVATE OWNER INDUSTRIAL STATUS = 0
Field width: 5 digits
Values: 00001-99999

ITEM R206 TRACT SIZE (PERCENT FOREST)

Record the percentage of the tract that is forested. See Ownership Procedures in Section 0.3.

When collected: TRACT SIZE (TOTAL ACRES) is collected
Field width: 3 digits
Values: 001-100

ITEM 2403 PRESENT FOREST TYPE (CORE 2.4.3)

Record the code corresponding to the forest type (from Appendix 2) that best describes the species with the plurality of stocking for all live trees in the condition class that are not overtopped.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 3 digits
Values:

White-Red-Jack Pine Group

103 Eastern white pine
104 White pine/hemlock
105 Eastern hemlock

Spruce-Fir Group

121 Balsam fir
123 Red spruce
124 Red spruce/balsam fir

Longleaf-Slash Pine Group

141 Longleaf pine
142 Slash pine

Loblolly-Shortleaf Pine Group

161 Loblolly pine
162 Shortleaf pine
163 Virginia pine
164 Sand pine
165 Table-mountain pine
166 Pond pine
167 Pitch pine
168 Spruce pine

Pinyon-Juniper Group

181 Eastern redcedar
182 Rocky Mountain juniper
184 Juniper woodland
185 Pinyon juniper

Ponderosa Pine Group

221 Ponderosa pine

Other Western Softwoods Group

366 Limber pine
368 Miscellaneous western softwoods

Exotic Softwoods Group

381 Scotch pine
382 Australian pine
383 Other exotic softwoods
384 Norway spruce

Oak-Pine Group

401 E. white pine/n. red oak/ white ash
402 Eastern redcedar/ hardwood
403 Longleaf pine/oak
404 Shortleaf pine/oak
405 Virginia pine/southern red oak
406 Loblolly pine/hardwood
407 Slash pine/hardwood
409 Other pine/hardwood

Oak-Hickory Group
501 Post oak/blackjack oak
502 Chestnut oak
503 White oak/red oak/hickory
504 White oak
505 Northern red oak
506 Yellow-poplar/white oak/red oak
507 Sassafras/persimmon
508 Sweetgum/yellow-poplar
509 Bur oak
510 Scarlet oak
511 Yellow-poplar
512 Black walnut
513 Black locust
514 Southern scrub oak
515 Chestnut oak/black oak/scarlet oak
519 Red maple/oak
520 Mixed upland hardwoods

Oak-Gum-Cypress Group
601 Swamp chestnut oak/cherrybark oak
602 Sweetgum/nuttall/willow oak
605 Overcup oak/water hickory
606 Atlantic white-cedar
607 Baldcypress/water tupelo
608 Sweetbay/swamp tupelo/red maple

Elm-Ash-Cottonwood Group
701 Black ash/American elm/red maple
702 River birch/sycamore
703 Cottonwood
704 Willow
705 Sycamore/pecan/American elm
706 Sugarberry or hackberry/elm/green ash
707 Silver maple/American elm
708 Red maple (lowland)
709 Cottonwood/willow

Maple-Beech-Birch Group
801 Sugar maple/beech/yellow birch
802 Black cherry
803 Cherry/ash/yellow-poplar
805 Hard maple/basswood
807 Elm/ash/locust
809 Red maple (upland)

Western Oak Group
925 Deciduous oak woodland

Other Western Hardwoods Group
952 Mesquite woodland
955 Miscellaneous western hardwood woodlands

Tropical Hardwoods Group
981 Sabal palm
982 Mangrove
989 Other tropical

Exotic Hardwoods Group
991 Paulownia
992 Melaleuca
993 Eucalyptus
995 Other exotic hardwoods

999 Non-stocked

ITEM R207 NEW PAST FOREST TYPE

Record the code that best describes the past forest type of the condition **if the current procedures had been used at the previous inventory**. Use previous cruiser sketch maps, old photos, and all relevant information when determining the past forest type status. Only differ with the previous forest type if it is OBVIOUS that it would have been different if the current procedures had been used, or that the previous cruiser was in error.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 3 digits
Values: Use same codes for PRESENT FOREST TYPE

ITEM 2404 STAND SIZE CLASS (CORE 2.4.4)

Record the code that best describes the predominant size class of all live trees in the condition class that are not overtopped.

When collected: If SIMILAR CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0 Nonstocked:
Meeting the definition of accessible forest land, and one of the following applies:

(a) less than 10 percent stocked by trees of any size, and not classified as cover trees, or

(b) for forest types where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.

1 Up to 4.9 in (seedlings / saplings)
At least 10 percent stocking in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 in DBH.

2 5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods)
At least 10 percent stocking in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH.

3 9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods)
At least 10 percent stocking in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH.

4 20.0 – 39.9 in
At least 10 percent stocking in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.

5 40.0 + in
At least 10 percent stocking in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH **and** the plurality of the crown cover is in trees ≥ 40.0 in DBH.

6 Cover trees (non-tallied):
Less than 10 percent stocking by trees of any size, and greater than 5 percent **crown cover** of species that comprise cover trees.

Within the sampled area on microplot, subplot, or annular plot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. Use tree stocking of all live trees that are not overtopped to differentiate between stand-size classes.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5% of the crown cover in STAND SIZE CLASSES of 1,2,3,4, and 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is either 0 or 6 depending on the characteristics of the stand. If at least 1/3 of crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), the accessible forested condition will be classified in one of these STAND SIZE CLASSES based on which of these STAND SIZE CLASSES has the most crown cover. If less than 1/3 of the crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), classify the accessible forested condition as a STAND SIZE CLASS = 1, if adequate cover is present.

If no other condition class defining variables are different between accessible forest conditions on a subplot, then delineate on differences in STAND SIZE CLASS only for the following combinations:

Between Nonstocked (STAND SIZE CLASS = 0) or cover trees (STAND SIZE CLASS = 6) and any stocked forest land (1, 2, 3, 4, or 5);
Between STAND SIZE CLASS = 1 and STAND SIZE CLASS = 3, 4, and 5;
Between STAND SIZE CLASS = 2 and STAND SIZE CLASS = 4 and 5; or
Between STAND SIZE CLASS = 3 and STAND SIZE CLASS = 5.

Note: Differing stand size classes can be used to describe separate condition classes, while at the same time not be used to delineate separate condition classes. Example: Two adjacent forested stands of the same forest type, one with a STAND SIZE CLASS = 1 and the other with a STAND SIZE CLASS = 2 could be delineated on a subplot as a separated CONDITION CLASS if one of the other condition class delineation variables differs (based on the rules), i.e. OWNER GROUP differs between the two condition classes. In addition, the STAND SIZE CLASS variables for the two condition classes would be recorded and treated as an ANCILLARY variable.

ITEM 2405 PRESENT REGENERATION STATUS (CORE 2.4.5)

Record the code that best describes the degree of evidence of artificial regeneration, which occurred in the condition.

When collected: If SIMILAR CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0	Natural	Present stand shows no clear evidence of artificial regeneration. Includes unplanted, recently cut lands.
1	Artificial	Present stand shows clear evidence of artificial regeneration.

For a forest land condition to be delineated and/or classified as artificially regenerated, the condition must show distinct evidence of planting or seeding. If it is difficult to determine whether or not a stand has been planted or seeded, then use code 0. If no distinct boundary exists within the sampled (fixed-radius) area on any subplot, then do not recognize separate conditions.

Note: Plot records or verbal evidence from landowner is acceptable for determining regeneration status.

ITEM R209 NEW PAST REGENERATION STATUS

Record the code that best describes the degree of evidence of artificial regeneration of the condition **if the current procedures had been used at the previous inventory**. Use previous cruiser sketch maps, old photos, and all relevant information when determining the past regeneration status. Only differ with the previous condition status if it is OBVIOUS that it would have been different if the current procedures had been used, or that the previous cruiser was in error.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values: Use the same codes as PRESENT REGENERATION STATUS

ITEM 2409 ARTIFICIAL REGENERATION SPECIES (CORE 2.4.9)

Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand. This attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0, PRESENT CONDITION STATUS = 1, and PRESENT REGENERATION STATUS = 1
Field width: 3 digits
Values: See Appendix 3

ITEM 2406 TREE DENSITY (CORE 2.4.6)

Record a code to indicate the relative tree density classification. Base the classification on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in section 2.1 and 2.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate condition classes are homogenous, i.e. when a change in density is the ONLY difference in what would otherwise be treated as one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy but not total tree mortality due to a ground fire. Delineation by density should only be done when the less-dense condition is 50% or less as dense as the denser condition.

Do not distinguish between low stocked stands or stands of sparse and patchy forest.

When collected: If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

1 Initial density class
2 Density class 2 - density different than 1
3 Density class 3 - density different than 1 and 2

In order to qualify as a separate condition based on density, there MUST be a distinct, easily observed change in the density of an area's tree cover or basal area.

Examples of valid contrasting conditions defined by differences in tree density are forest land conditions with the same type, origin, stand size, ownership, and reserved status, but:

- the eastern half of an otherwise homogeneous, 20 ac stand has many trees killed by a bark beetle outbreak,

or

- one portion of a stand is partially cut over (with 40 sq. ft basal area per ac) while the other portion is undisturbed (with 100 sq. ft basal area per ac).

ITEM 2410 STAND AGE (CORE 2.4.10)
Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition. Record 000 for non-stocked stands.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for site tree age, estimates of stand age should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

To estimate STAND AGE, select two or three dominant or codominant trees from the overstory. If the overstory covers a wide range of tree sizes and species, try to select the trees accordingly, but it is not necessary to core additional trees in such stands. The variance associated with mean stand age increases with stand heterogeneity, and additional cores are not likely to improve the estimate. Core each tree at the point of diameter measurement and count the rings between the outside edge and the core to the pith. Add in the number of years that passed from germination until the tree reached the point of core extraction to determine the total age of the tree. Add : longleaf — 7 years; other pines— 3 years; hardwoods— 2 years. Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

$(34 \times 0.25) + (62 \times 0.60) + (59 \times 0.15) = 55$ years.

In some cases, it may be possible to avoid coring trees to determine age. If a stand has not been seriously disturbed since the previous survey, simply add the number of years since the previous inventory to the previous STAND AGE. In other situations, cores collected from site trees can be used to estimate STAND AGE.

If a condition class is nonstocked, assign a STAND AGE of 000.

If all of the trees in a condition class are not suitable to be bored for age (e.g. rotten cores, unable to read growth rings), then record 998. This code should be used in these cases only.

When collected: If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 3 digits
Values: 000 to 199, 998

ITEM R211 STAND STRUCTURE

Record the code that best describes the predominant canopy structure for the condition. When determining canopy structure, only consider the vertical position of the dominant and codominant trees in the stand. Do not consider trees that are intermediate or overtopped crown class. As a rule of thumb, a different story should comprise 25% of the stand.

When collected: If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

1 Single-storied - Most of the dominant/codominant tree crowns form a single canopy (i.e., most of the trees are approximately the same height).

2 Two-storied - The dominant/codominant tree crowns form two distinct canopy layers or stories.

3 Multi-storied - More than two recognizable levels characterize the crown canopy. Dominant/codominant trees of many sizes (diameters and heights) for a multilevel canopy.

4 Non-stocked - The condition is less than 10% stocked.

ITEM R220 DISTURBANCES?
ITEM R221 TREATMENTS?

Record the code indicating the presence or absence of disturbances and treatments on the condition.

When collected: On data recorder only; If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0 No
1 Yes

ITEM 2411, 2413, 2415 DISTURBANCE 1, 2, 3 (CORE 2.4.11, 2.4.13, 2.4.15)

Record the code that meets the threshold of the following disturbances. Disturbance can connote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 ac in size. Record up to three different disturbances per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the disturbance must be within the last 5 years. For remeasured plots recognize only those disturbances that have occurred since the previous inventory.

The disturbance codes below require "significant threshold" damage, which implies mortality and/or damage to 25 percent of individual trees in the condition class.

When collected: If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 2 digits
Values:

- 00 None - no observable disturbance
- 10 Insects
- 20 Disease
- 30 Fire (from crown and ground fire, either prescribed or natural)
  - 31 ground fire
  - 32 crown fire
- 40 Animal other than the following:
  - 41 beaver (includes flooding caused by beaver)
  - 42 porcupine
  - 43 deer/ungulate
  - 45 domestic animal/livestock (includes grazing)
- 50 Weather other than the following:
  - 51 ice
  - 52 wind (includes hurricane, tornado)
  - 53 flooding (weather-induced)
  - 54 drought
- 60 Vegetation (suppression, competition, vines)
- 70 Unknown / not sure / other (include in NOTES)
- 80 Human - Any significant threshold human-caused damage not described in the DISTURBANCE codes listed above or the TREATMENT codes listed below.

ITEM 2412, 2414, 2416 DISTURBANCE YEAR 1, 2, 3 (CORE 2.4.12, 2.4.14, 2.4.16)
Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: If PRESENT CONDITION STATUS = 1 and SIMILAR IDENTIFIED CONDITION CLASS NUMBER = 0
Field width: 4 digits
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time.

ITEM 2417, 2419, 2421 TREATMENT 1, 2, 3 (CORE 2.4.17, 2.4.19, 2.4.21)
Record the code corresponding to the presence of one of the following treatments since the last inventory cycle or within the past 5 years. The area affected by any treatment must be at least 1.0 ac in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the treatment must be within the last 5 years. For remeasured plots recognize only those treatments that have occurred since the previous inventory.
When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 2 digits
Values:

00 None - No observable treatment that meets the 25% threshold.

10 Other Cutting - Miscellaneous cutting that has little or no impact on present or future stand conditions. Includes cutting for firewood, fence posts, and salvage cuts typified by sparse cutting.

11 Clearcut harvest – The removal of the majority of the merchantable trees in a stand; residual stand stocking is under 50 percent.

12 Partial harvest – Removal primarily consisting of highest quality trees. Residual consists of lower quality trees because of high grading or selection harvest.

13 Seed-tree/shelterwood harvest – Crop trees are harvested leaving seed source trees either in a shelterwood or seed tree. Also includes the final harvest of the seed trees.

14 Commercial thinning – The removal of trees (usually poletimber sized) from poletimber-sized stands leaving sufficient stocking of growing stock trees to feature in future stand development. Also included are thinning in sawtimber-sized stands where poletimber-sized (or log-sized) trees have been removed to improve quality of those trees featured in a final harvest.

15 Timber Stand Improvement (cut trees only) – The cleaning, release, or other stand improvement involving non-commercial cutting applied to an immature stand that leaves sufficient stocking. Use code 50 for herbicide, girdling, and other TSI treatments that do not involve cutting. Use code 14 for commercial thinnings.

20 Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.

30 Artificial regeneration - Planting or direct seeding has resulted in a stand at least 50% stocked with live trees of any size.

40 Natural regeneration - Growth of existing trees and/or natural seeding has resulted in a stand at least 50% stocked with live trees of any size.

50 Other silvicultural treatment - The use of fertilizers, herbicides, girdling, pruning or other activities (not already listed above) designed to improve the commercial value of the residual stand.

ITEM 2418, 2420, 2422 TREATMENT YEAR 1, 2, 3 (CORE 2.4.18, 2.4.20, 2.4.22)
Record the year in which TREATMENT 1, 2, and 3 occurred.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 4 digits
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

ITEM 2423 PHYSIOGRAPHIC CLASS (CORE 2.4.23)
Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition; land form, topographic position, and soil generally determine physiographic class. As a rule of thumb, look over the annular plot area to determine physiographic class, but always use your best judgment when assessing any condition level variables.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 2 digits
Values:

Xeric Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.

11 Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.

12 Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.

13 Deep Sands - Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams, and many deserts.

19 Other Xeric - All dry physiographic sites not described above.

Mesic Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.

21 Flatwoods - Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.

22 Rolling Uplands - Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated flood plains.

23 Moist Slopes and Coves - Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.

24 Narrow Flood plains/Bottomlands - Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs.

25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces. Excludes swamps, sloughs, and bogs with year-round water problems.

29 Other Mesic - All moderately moist physiographic sites not described above.

Hydric Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where excess water seriously limits both growth and species occurrence.

31 Swamps / Bogs - Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.

32 Small Drains - Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.

33 Bays and wet pocosins - Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include sites in the Lake States with lowland swamp conifers or the Carolina bays in the southeast US.

34 Beaver ponds

35 Cypress ponds

39 Other hydric - All other hydric physiographic sites.

ITEM R212 OPERABILITY

This variable focuses on the viability of operating logging equipment in the vicinity of the condition. Record the most limiting class code that occurs on each forest condition.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1

Field width: 1 digit

Values:

0	No problems.
1	Seasonal access due to water conditions in wet weather.
2	Mixed wet and dry areas typical of multi-channeled streams punctuated with dry islands.
3	Broken terrain, cliffs, gullies, outcroppings, etc., which would severely limit equipment, access or use.
4	Year-round water problems (includes islands).
5	Slopes of 20 percent or more.

ITEM R213 WATER SOURCE

Record the code that best describes the water source that has the greatest impact on the condition. The water source must be within 1000 ft of the lowest numbered subplot center containing that condition in order to be coded.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1

Field width: 1 digit

Values:

0	None - no water source within 1,000 feet
1	Intermittent water – seasonal and well-defined stream channel or body of water that is dry for long periods, but generally flows or contains water throughout the wet season
2	Permanent streams or canals less than 30 feet in width
3	Permanent streams or canals 30 – 199 feet in width
4	Permanent streams or canals 200 feet or larger in width
5	Permanent water in the form of deep swamps, bogs, or marshes less than 4.5 acres in size
6	Permanent water in the form of deep swamps, bogs, or marshes 4.5 acres or larger in size
7	Permanent lakes or ponds less than 4.5 acres in size
8	Permanent lakes or ponds 4.5 acres or larger in size
9	Other permanent water (includes ocean)

ITEM R214 DISTANCE TO WATER SOURCE

Record the distance to the water source from the lowest numbered subplot center containing that condition. Distances greater than 100 feet can be measured on the photo.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0, PRESENT CONDITION STATUS = 1
Field width: 3 digits
Values:

000 – 100	Distance to nearest foot (taped on site)
150	101 – 200 feet
250	201 – 300 feet
*	*
*	*
*	*
950	901 – 1,000 feet
999	None within 1,000 feet

ITEM R215 SITE CLASS

Record the site class of the condition. If there is a site class curve in Appendix 4 for one of the site trees collected for the condition, then record 0 and the site class will be determined in the office. If none of the site trees collected for the condition have a site class curve in Appendix 4, then estimate the site class.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0, PRESENT CONDITION STATUS = 1, and site trees not collected.
Field width: 1 digit
Values: 0-7

ITEM R216FIRE

Record the presence or absence of fire on the condition since the last survey. Evidence of fire must occur within the subplot.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0	No evidence of fire since last survey
1	Evidence of burning (either prescribed or wild fire)

ITEM R217 GRAZING

Record the presence or absence of domestic animal grazing on the condition since the last survey. Evidence of grazing must occur within the subplot.

When collected: If SIMILAR IDENTIFIED CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0	No evidence of livestock use (by domestic animals)
1	Evidence of grazing (including dung, tracks, trails, etc.)

ITEM R218 CONDITION LEVEL NOTES

Record notes pertaining to the condition as called for to explain or describe another variable and to identify special circumstances.

When collected: All condition classes
Field width: Alphanumeric character field
Values: English language words, phrases and numbers

3.0 BOUNDARY REFERENCES

Boundary reference data are used to remeasure plots and to compute the area for the condition classes sampled on a plot. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and microplots. Boundaries outside sampled (fixed-radius) areas are not referenced.

In addition to the recording procedures described herein, sketch maps of condition class boundaries onto the pre-printed plot diagrams on field tally sheets.

3.1 REFERENCE PROCEDURE

Reference, within the sampled area on each microplot and subplot, the approximate boundary of each condition class that differs from the condition class at a subplot center. Trees selected on these fixed-radius plots are assigned to the actual condition in which they lie regardless of the recorded approximate boundary.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points (Figures 7 and 8). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference, and one "corner" point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

Microplot boundaries are referenced to the microplot center in the same manner described for subplots. Note that the larger the plot, the greater likelihood of a need for a boundary corner to record boundaries that are not straight lines.

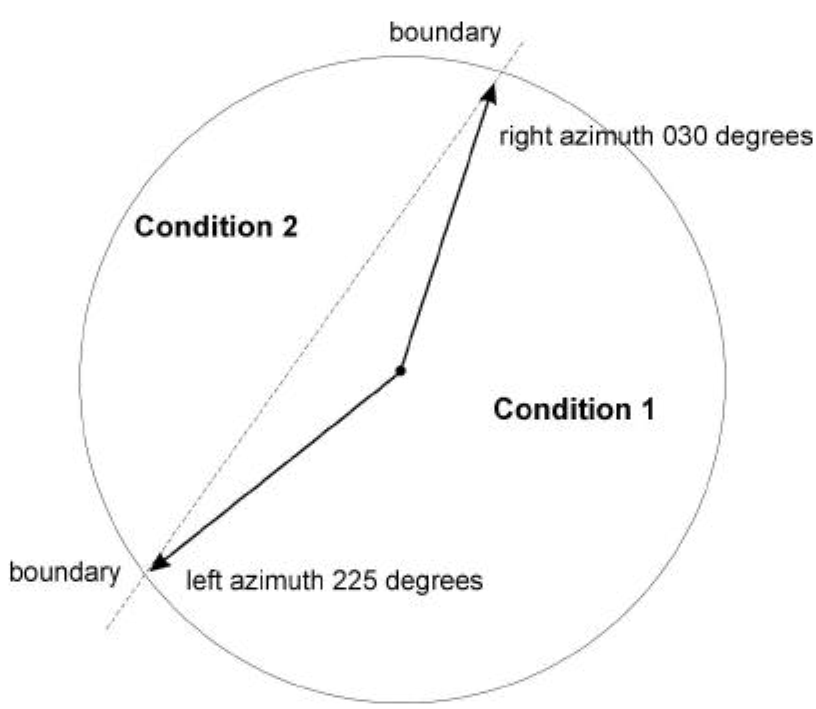


Figure 7. How to measure a straight boundary on a microplot or subplot.

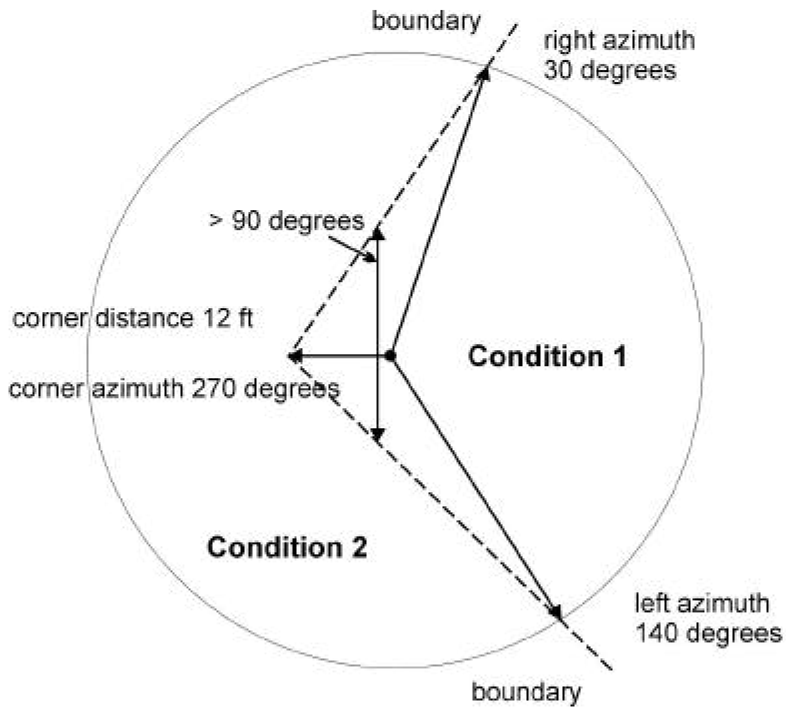


Figure 8. How to measure a boundary with a corner on a subplot.

Refer to Sections 2.1 and 2.3 for general mapping guidelines. The following additional rules apply when referencing a boundary within a subplot or microplot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water's edge along a stream course, ditch, or canal.

2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge.

3. When a boundary between two contrasting forest land condition classes is not clearly marked, map along the stems of the contrasting condition. When the boundary between two contrasting forest land condition classes is separated by a narrow linear inclusion (creek, fire line, narrow meadow, unimproved road), establish the boundary at the far edge, relative to subplot center, of the inclusion.

4. When a plot is remeasured, the crew will examine the boundaries referenced at last inventory. If no change has occurred, the current crew will retain the boundary data that were recorded at last inventory. If a boundary has changed, a new boundary is present, or the previous crew made an obvious error, then record new boundary data. Delete boundaries that are no longer distinct.

5. Although individual MQOs are specified for the azimuths and distances (see Appendix 6), in practice a crew will be considered ‘correct’ when the difference in areas as mapped by the original crew and by the QA crew is less than 10% of the subplot or microplot area.

3.2 BOUNDARY DATA

Record the appropriate values for each boundary mapped on the subplot or microplot as follows:

ITEM 3201 SUBPLOT NUMBER (CORE 3.2.1)

Record the code corresponding to the number of the subplot.

When collected: All boundaries
Field width: 1 digit
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

ITEM 3202 PLOT TYPE (CORE 3.2.2)

Record the code to specify whether the boundary data are for a subplot or microplot.

When collected: All boundaries
Field width: 1 digit
Values:

1 Subplot boundary
2 Microplot boundary

ITEM 3203 BOUNDARY CHANGE (CORE 3.2.3)

Remeasurement (SAMPLE KIND = 2) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

When collected: SAMPLE KIND = 2, All boundaries
Field width: 1 digit
Values:

0 No change - boundary is the same as indicated on plot map by a previous crew.

1 New boundary, or boundary data has been changed to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded.

2 Boundary has been changed to correct an obvious, gross error from previous crew, not a difference in opinion.

3 Boundary has been changed to reflect a change in variable definition (procedural change).

ITEM 3204 CONTRASTING CONDITION (CORE 3.2.4)

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line.

When collected: All boundaries
Field width: 1 digit
Values: 1 to 9

ITEM 3205 LEFT AZIMUTH (CORE 3.2.5)

Record the azimuth from the subplot or microplot center to the farthest left point (facing the contrasting condition class) where the boundary intersects the subplot or microplot circumference.

When collected: All boundaries
Field width: 3 digits
Values: 001 to 360

ITEM 3206 CORNER AZIMUTH (CORE 3.2.6)

Record the azimuth from the subplot or microplot center to a corner or curve in a boundary. If a boundary is best described by a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

When collected: All boundaries
Field width: 3 digits
Values: 000 to 360

ITEM 3207 CORNER DISTANCE (CORE 3.2.7)

Record the horizontal distance, to the nearest 1 ft, from the subplot or microplot center to a boundary corner point.

When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 2 digits
Values:
Microplot: 01 to 07
Subplot: 01 to 24

ITEM 3208 RIGHT AZIMUTH (CORE 3.2.8)

Record the azimuth from subplot or microplot center to the farthest right point (facing the contrasting condition) where the boundary intersects the subplot or microplot circumference.

When collected: All boundaries
Field width: 3 digits
Values: 001 to 360

4.0 SUBPLOT INFORMATION

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the microplot, since the microplot is contained within the subplot perimeter. If the subplot center cannot be accessed, do not collect and record data on the subplot except for SUBPLOT NUMBER and SUBPLOT CENTER CONDITION.

ITEM 4010 SUBPLOT NUMBER (CORE 4.1)

Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

ITEM 4020 SUBPLOT CENTER CONDITION (CORE 4.2)

Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

When collected: All subplots
Field width: 1 digit
Values: 1 to 9

ITEM 4030 MICROPLOT CENTER CONDITION (CORE 4.3)

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

When collected: All microplots where subplot center is CONDITION STATUS = 1, 2, 3, 7, or 9
Field width: 1 digit
Values: 1 to 9

ITEM 4080 SUBPLOT CONDITION LIST (CORE 4.8)

This is a listing of all condition classes located within the 24.0-ft radius around the subplot center. A maximum of four conditions is permitted at any individual subplot. If a condition class has already been defined at a previously completed subplot, use the same condition class number whenever that condition is encountered. Define new condition classes as they are encountered. If more than one condition class is listed here, boundary data are required. If only one condition class is listed, this condition is automatically assigned to the subplot center and microplot center. If less than four condition classes occur on this subplot, complete the remainder of this field with zeros. For example, if condition 1 is the only condition class on a subplot, record 1000.

When collected: All subplots
Field width: 4 digits
Values: 1000 to 9876

ITEM 4040 SUBPLOT SLOPE (CORE 4.4)

Record the angle of the slope across the subplot to the nearest 1 percent. SUBPLOT SLOPE is determined by sighting the clinometer along a line parallel to the average incline (or decline) of each subplot. This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure SUBPLOT SLOPE, Observer 1 should stand at the uphill edge of the subplot and sight Observer 2, who stands at the downhill edge of the subplot. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

If slope changes gradually across the subplot, record an average slope. If slope changes across the subplot but the slope is predominately of one direction, code the predominate slope percentage rather than the average. If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the slope as follows:

- If the subplot falls directly between two side hills, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 3 digits
Values: 000 to 155

ITEM 4050 SUBPLOT ASPECT (CORE 4.5)

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope. If aspect changes gradually across the subplot, record an average aspect. If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.

If the subplot falls on or straddles a canyon bottom or narrow ridge top, code aspect as follows:

- Code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 3 digits
Values:

000	no aspect, slope < 5 percent
001	1 degree
002	2 degrees
.	.
.	.
360	360 degrees, due north

ITEM 4060 SNOW/WATER DEPTH (CORE 4.6)

Record to the nearest 0.1 ft the average approximate depth of water or snow covering the subplot at the time of data collection. This variable is used to indicate subplots where some variables (e.g., seedling count, total heights) may be measured with less certainty due to conditions at the time of measurement. Only record this item when it impedes data collection.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 2 digits (x.y)
Values: 0.0 to 9.9

ITEM R401, R403, R405, R407 INVASIVE EXOTIC PEST PLANTS OF THE SOUTH

Identify and code the occurrence of up to 4 invasive exotic pest plants listed below that are found on any accessible forest portion of the subplot. **Do not record on nonforest conditions.**

If more than 4 pest plants are found on a subplot, code in order of most cover to least. **Stop at four species per subplot. If 5 species are found on subplot 1, record only four species, even if subplot 2 has none.**

If less than 4 pest plants are found on a subplot, record the presence of any of the following pest plants that occur off, but near the subplot. An exhaustive search outside the subplot boundary is not required. But if an exotic plant listed below is observed while completing other work on the subplot, record the species code and a COVERAGE = 9. This is only done when there are less than four species on the subplot.

The species below are known to cause ecological problems. All are displacing native forest communities. Species with an asterisk (*) have been recommended as prohibited from introduction on National Forest land. The impact of invasive species is locally well known, but their abundance, regional impact, range and rate of spread in the environment are not well known. Nomenclature follows USDA NRCS PLANTS National Database (http://plants.usda.gov/). The most common synonyms are in parentheses.

The first digit of the code identifies the lifeform of the species in question:

0=tree	4=grass
2=shrub	5=fern
3=vine	6=forbs, herbs, and other nonwoody species.

When collected: On the forested portion of all subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 4 digits
Values: see below; use 0000 for none

Southern Region Exotic/Invasive Pest Plants

Choose up to four species from this list before recording species off of any applicable state species list.

CODE	COMMON NAME	SCIENTIFIC NAME
	TREES	
0341	Tree-of-heaven	Ailanthus altissima*
0345	Silktree, Mimosa	Albizia julibrissin*
0712	Princesstree, Royal Paulownia	Paulownia tomentosa*
0993	Chinaberry	Melia azedarach
0994	Tallowtree, Popcorntree	Triadica sebifera (Sapium sebiferum)*
0997	Russian Olive	Elaeagnus angustifolia
	SHRUBS	
2037	Silverthorn, Thorny Olive	Elaeagnus pungens
2038	Autumn olive	Elaeagnus umbellata
2042	Winged Burning Bush	Euonymus alata
2103	Chinese/European privet	Ligustrum sinense*/L. vulgare
2104	Japanese privet	Ligustrum japonicum*
2105	Bush honeysuckles	Lonicera spp.*
2113	Sacred bamboo, Nandina	Nandina domestica
2160	Exotic roses	Rosa spp.
	VINES	
3026	Oriential or Asian bittersweet	Celastrus orbiculatus
3030	Exotic climbing yams – air yam/chinese yam	Dioscorea bulbifera*/ D. oppositifolia
3042	Wintercreeper	Euonymus fortunei
3101	Japanese honeysuckle	Lonicera japonica*
3123	Kudzu	Pueraria montana var. lobata (Pueraria lobata)*
3211	Exotic Vincas, Periwinkles	Vinca minor/V. major
3251	Chinese/Japanese wisteria	Wisteria sinensis*/ W. floribunda
	GRASSES	
4008	Giant reed	Arundo donax
4051	Tall fescue	Lolium arundinaceum*
4055	Cogongrass	Imperata cylindrica*
4080	Nepalese browntop	Microstegium vimineum*
4085	Chinese silvergrass	Miscanthus sinensis*
4130	Exotic bamboos	Phyllostachys spp. Bambusa spp
	FERNS	
5171	Japanese climbing fern	Lygodium japonicum*
	FORBS/HERBS/OTHER HERBACEOUS	
6002	Garlic mustard	Alliaria petiolata*
6052	Shrubby lespedeza	Lespedeza bicolor
6053	Chinese lespedeza	Lespedeza cuneata*
6095	Tropical soda apple	Solanum viarum*

Florida Exotic/Invasive Pest Plants

The following exotic/invasive pest plants are only tallied in Florida. Use this list only after first exhausting the regional list to record four plants per subplot. For example: If there are no exotic species from the regional list above on the subplot, then up to four species from the Florida list can be recorded. If there are three exotic species from the regional list above on the subplot, then only one species from the Florida list can be recorded. This procedure will be used until a new field data collection program is produced to accept state optional items.

CODE	COMMON NAME	SCIENTIFIC NAME
	TREES	
FL02	Australian-pines	Casuarina spp.
FL03	Camphor tree	Cinnamomum camphora
FL04	Carrotwood	Cupaniopsis anacardioides
FL06	Melaleuca	Melaleuca quinquenervia
FL08	Schefflera	Schefflera actinophylla
FL09	Java plum	Syzygium cumini
	SUBSHRUBS	
FL11	Coral ardisia	Ardisia crenata
FL15	Lantana	Lantana camara
	SHRUBS	
FL22	Surinam cherry	Eugenia uniflora
FL26	Guava spp.	Psidium spp.
FL27	Downy rose myrtle	Rhodomyrtus tomentosa
FL28	Brazilian pepper	Schinus terebinthifolius
FL29	Wetland nightshade	Solanum tampicense
	VINES	
FL31	Rosary pea	Abrus precatorius
FL35	Cat's-claw vine	Macfadyena ungis-cati
FL37	Skunk vines	Paederia spp.
	GRASSES	
FL46	Napier grass	Pennisetum purpureum
	FERNS	
FL54	Old World Climbing fern	Lygodium microphyllum
FL56	Sword fern	Nephrolepis cordifolia
	FORBS/HERBS/OTHER HERBACEOUS	
FL64	Hairy indigo	Indigofera hirsuta

ITEM R402, R404, R406, R408 EXOTIC PEST PLANT PERCENT COVERAGE

Record the code that best describes the abundance of each exotic pest plant recorded on the subplot. Rate winter vegetation as if it were in a "leaf-on" condition.

One percent cover of the 24-foot radius subplot is equivalent to a square 4.2 feet on each side, or a circle with a radius of 2.4 feet. Ten percent cover is equivalent to a square 13.4 feet on each side, or a circle with a radius of 7.6 feet.

However, only record the coverage on the forested portion of the subplot. For example, 70% of a subplot is nonforest and 30% is forested. If the entire subplot was covered by kudzu, then the EXOTIC PEST PLANT PERCENT COVERAGE is code 3 (11-50% coverage) for 30%.

When collected: EXOTIC PEST PLANTS > 0000
Field width: 1 digit
Values:

1	Trace < 01%
2	01-10%
3	11-50%
4	>50%
9	The exotic pest plant is found in the forest around the subplot area, but not on the subplot

5.0 TREE AND SAPLING DATA

Trees at least 5.0 inches in diameter are sampled within the subplot. 'Tally trees' are defined as all live and standing dead trees in accessible forest land condition classes encountered on the subplot the first time a subplot is established, and all trees that grow into a subplot thereafter. These data yield information on tree growth, mortality, removals; coarse woody debris; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Trees with a diameter at least 1.0 in but less than 5.0 in, termed saplings, are sampled within the microplot. 'Tally saplings' are defined as all live saplings in accessible forest land condition classes encountered the first time a microplot is established, and all saplings that grow into each microplot thereafter are included until they grow to 5.0 in or larger, at which time they are tallied on the 24.0 ft subplot and referenced (new azimuth and distance taken) to the subplot center

Trees are alive if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement. Trees that have been temporarily defoliated are still alive.

Once tallied, dead trees over 5.0 in diameter are tracked until they fall down. **Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be estimated.** To qualify as a standing dead tally tree, dead trees must be standing (LEAN ANGLE = 0) at least 4.5 ft tall and be at least 5.0 inches in diameter. Broken portions of trees that are completely separated from their base are not treated as separate trees.

Whether live or dead, standing trees do NOT have to be self-supported. They may be supported by other trees.

High stumps on naturally swell butted trees (where it is normal to cut above 4.5 ft) do not qualify as standing dead trees. Other trees that have been cut above 4.5 ft ("jump-butt") due to a fence or defect, are tallied if still standing at 4.5 ft.

Begin tallying trees at an azimuth of 001 degree from subplot center and continue clockwise around the subplot. Repeat this sequence for saplings on the microplot. **The following data is recorded for tally on the subplots and the new off-set microplots. See Supplements A and B for instructions on remeasuring tally that is ONLY on the previous co-located microplot tally or ONLY on the prism point plot.**

ITEM R501 ENTRY NUMBER

The entry number is pre-printed on tally sheets and is automatically created in Excel. If an entry is crossed out or omitted for any reason subsequent entry numbers must be manually renumbered.

When collected: All tally trees and entries to label no tally on sub/microplot
Field width: 3 digits
Values: 001 to 999

ITEM 5010 SUBPLOT NUMBER (CORE 5.01)

Record the subplot number where the tree occurs.

Also record for subplots that have no tally on the supblot or on the microplot either due to a Nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission, editing, or processing.

When Collected: All live and dead tally trees $\geq$ 1.0 in DBH
Field width: 1 digit
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

ITEM 5020 TREE RECORD NUMBER (CORE 5.02)

Record a code to uniquely and permanently identify each tree on a given subplot. The TREE RECORD NUMBERS must be unique within a subplot – being unique is more important than being sequential. In general, work clockwise from azimuth 001 to 360, and work outwards from subplot center to subplot edge. On remeasured plots, use the tree number assigned at the previous visit. Saplings tallied on microplots will retain their initially assigned tree number if they grow to tree size. Ingrowth, through growth and missed trees will be assigned the next available tree number. DO NOT renumber all plot trees in order to assign a more "correct" tree number to a missed tree. Numbers assigned to trees that are subsequently found to be extra will be dropped and not reused.

When Collected: All live and standing dead tally trees $\geq$ 1.0 in DBH
Field width: 3 digits
Values: 000 to 999

ITEM 5030 CONDITION CLASS NUMBER (CORE 5.03)

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 9).

When Collected: All live and standing dead tally trees $\geq$ 1.0 in DBH
Field width: 1 digit
Values: 1 to 9

Also record for subplots that have no tally on the supblot or on the microplot either due to a Nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission, editing, or processing.

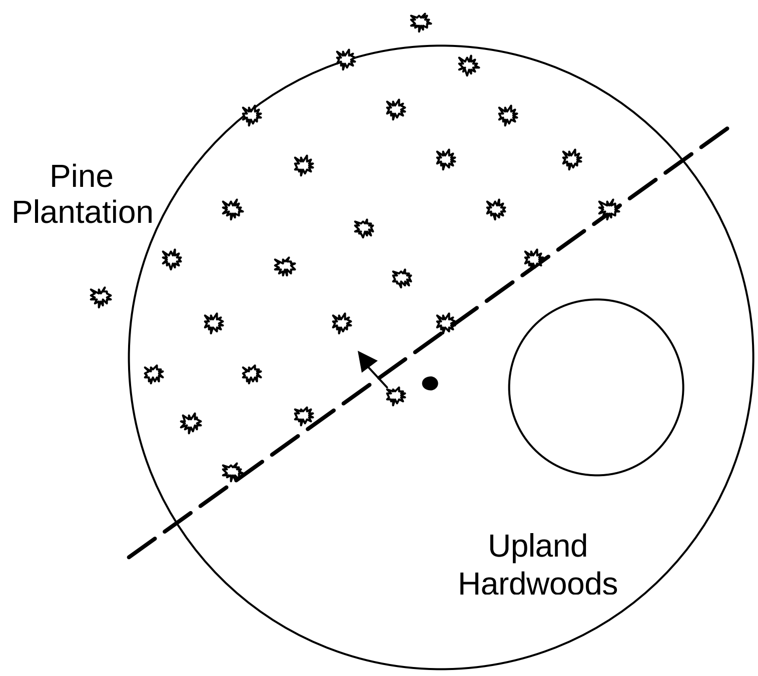


Figure 9. Ragged CONDITION CLASS boundary and tree condition class designation.

ITEM 5040 AZIMUTH (CORE 5.04)

Record the AZIMUTH from the subplot center (for trees ≥ 5.0 in DBH) or the microplot center (for saplings ≥ 1.0 in and < 5.0 in DBH), sight the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

Note: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH
Field width: 3 digits
Values: 001 to 360

ITEM 5050 HORIZONTAL DISTANCE (CORE 5.05)

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 ft, from the subplot center (for trees ≥ 5.0 in DBH) or microplot center (for saplings ≥ 1.0 in and < 5.0 in DBH) to the pith of the tree at the base.

Note: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH
Field width: 3 digits (xx.y)
Values: Microplot: 001 to 068
Subplot: 001 to 240

ITEM 5060 PRESENT TREE STATUS (CORE 5.06)

Record a PRESENT TREE STATUS for each tallied tree; this code is used to track the status of sample trees over time: as they first appear, as ingrowth, as they survive, and when they die or are removed. This information is needed to correctly assign volume information to the proper component of volume change.

Note: For microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All new live tally trees ≥ 1.0 in DBH
All new dead tally trees ≥ 5.0 in DBH
On remeasurement plots, all previously tallied trees

Field width: 1 digit

Values:

0 No status –- tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous survey or currently is not tallied due to definition or procedural change.

1 Live tree – any live tree (new, remeasured or ingrowth)

2 Dead tree -- any dead tree (new, remeasured, or ingrowth), regardless of cause of death, which does not qualify as a removal.

3 Removal - a tree that has been cut or killed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree may, or may not, have been utilized. Only code trees killed by fire as removals if it was a prescribed burn.

4 Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc. (remeasurement plots only). On SK= 2 plots: record this code for snags that no longer qualify as standing dead.

Note: For microplot trees (saplings) which become trees, crews must collect new azimuth and distance information from the subplot center.

ITEM R510 PAST TREE STATUS

Record the appropriate PAST TREE STATUS code for each remeasurement tree.

When collected: All SAMPLE KIND = 2 remeasurement trees.

Field width: 1 digit

Values:

1 Live tree – remeasured live tree

2 Dead tree -- remeasured dead tree

ITEM 5061 NEW TREE RECONCILE (CORE 5.6.1)

For remeasurement locations only, record a NEW TREE RECONCILE for any new tally tree that was not tallied in the previous inventory; this code is used to identify the reason a new tree appeared in the inventory. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: On SAMPLE KIND 2; all new live tally trees ≥ 1.0 inch DBH (TREE STATUS =1) and all new dead tally trees ≥ 5.0 in (TREE STATUS=2) on remeasured microplots and remeasured subplots only

Field width: 1 digit

Values:

1 Ingrowth – new tally tree not qualifying as through growth **(includes reversions)**.

2 Through growth – new tally tree 5 inches DBH and larger, within the **remeasured** microplot.

3 Missed live – a live tree missed at previous inventory and that is live, dead or removed now. Also use this code to account for trees that were not tallied at the previous inventory, but are now due to any procedural changes (DBH rule changes, forking rule changes, etc.)

4 Missed dead – a dead tree missed at previous inventory and that is dead or removed now.

ITEM 5070 LEAN ANGLE (CORE 5.07)

Record the code that describes the angle of lean from vertical of the tree, from base to top of ACTUAL LENGTH. Trees supported by other trees or by their own branches are evaluated like self-supporting trees.

To qualify as a standing dead tally tree, dead trees must be standing (LEAN ANGLE = 0) at least 4.5 ft tall and be at least 5.0 inches in diameter. Broken portions of trees that are completely separated from their base are not treated as separate trees.

When Collected: All tally trees ≥ 5.0 in DBH

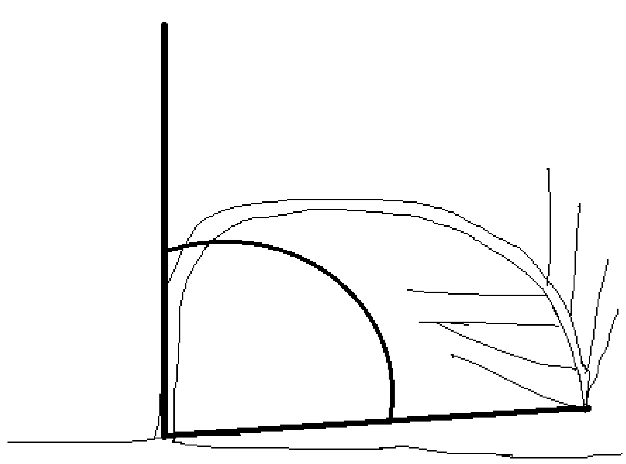
Field width: 1 digit

Values:

0 Standing (less than 45 degrees of lean)

1 Down (more than 45 degrees of lean)

Draw a line from the base of the tree to the top of ACTUAL LENGTH. Measure the angle form vertical.



ITEM 5080 SPECIES (CORE 5.08)

Record the appropriate SPECIES code from the list in Appendix 3. Use code 299 for unknown dead conifers and 999 for unknown dead hardwood when the generic or species codes cannot be used. The generic code (e.g. 400, 540) should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. If the species cannot be determined in the field, tally the tree, but bring branch sample, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. If you encounter a species not listed in Appendix 3 and are not sure if it should be tallied as a tree, record code 998 for miscellaneous species and consult your Field Supervisor. Record the species name in the tree notes item and collect a sample for your supervisor using the procedures described above. Only use code 998 when the tree identified is not listed in Appendix 3. While there is no uniform definition of a tree, in general, it is a woody plant having one erect perennial stem or trunk, at least 5.0" diameter at breast height, with a more or less definitely formed crown of foliage, and a height of 13 feet at maturity.

When Collected: All live and standing dead tally trees $\geq$ 1.0 in DBH
Field width: 3 digits
Values: See Appendix 3

DIAMETER

Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-ft radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-ft radius subplots.

Remeasurement trees:

When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

ITEM 5092 CURRENT DIAMETER AT BREAST HEIGHT (DBH) (CORE 5.09.2)

Unless one of the special situations described in Appendix 3 is encountered, measure DBH at 4.5 ft above the ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For example, a reading of 3.68 inches is recorded as 3.6 inches.

When Collected: All live tally trees $\geq$ 1.0 in DBH and standing dead tally trees $\geq$ 5.0 in DBH
Field width: 3 digits (xx.y)
Values: 010 to 999

ITEM 5091 PREVIOUS DIAMETER AT BREAST HEIGHT (CORE 5.09.1)

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory onto the data recorder and/or on hardcopy.

When collected: All remeasurement tally trees
Field width: 3 digits (xx.y)
Values: 010 to 999

ITEM 5100 DIAMETER CHECK (CORE 5.10)

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses. Use code 2 for remeasurement trees only.

Note: If both codes 1 and 2 apply, use code 2.

When collected: All live and standing dead tally trees ≥ 1.0 in DBH
Field width: 1 digit
Values:

0	Diameter measured accurately
1	Diameter estimated, or tree shrunk due to bark slough by less than 0.2 inch
2	Diameter measured at different location than previous measurement; the previous diameter was estimated and the current diameter is measured accurately; previous diameter is obviously incorrect; or the tree shrunk by 0.2 inch or more

ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.23)

For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual length from the ground, to the nearest 0.1 ft, at which the diameter was measured for each tally tree, 1.0 in DBH and larger.

When collected: All live and dead tally trees
Field width: 3 digits
Values: 001 – 150

ITEM R512 P3 TREE NUMBER

Record the 3-digit FHM tree number assigned to each standing tree after matching the trees on the subplot to the hard copy list provided. Do not assign a P3 tree number to new trees. Record ‘000’ for any tree that was not tallied in the previous P3 inventory. On SAMPLE KIND = 1 or 3 plots, all trees should be assigned ‘000’.

When collected: All live and dead tally trees on Phase 3 plots ONLY
Field width: 3 digits
Values: 000 to 999

ITEM R503 TREE CLASS

Record the code that indicates the tree class. All palm species are coded TREE CLASS 3.

When Collected: All live tally trees $\geq$ 1.0 in DBH, all mortality trees $\geq$ 5.0 in DBH

Field width: 1 digit

Values:

2 Growing stock — Trees with one-third or more of the gross board foot volume in the entire sawlog section with commercial logs meeting grade, soundness, and size requirements or the potential to do so for poletimber-sized trees. A tree class 2 tree must have one 12-foot log or two 8-foot logs, now or prospectively, for live poletimber-sized trees to qualify as growing stock. Mortality pole size trees can never grow to be sawlog size, so are never TREE CLASS =2.

3 Rough cull — Trees that do not contain at least one 12-foot sawlog or two 8-foot logs now or prospectively, primarily because of roughness or poor form. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and less than 1/2 of the cubic-foot cull is rotten or unsound.

4 Rotten cull — Trees that do not contain at least one 12-foot sawlog or two 8-foot logs now or prospectively and/or do not meet grade specifications for percent sound primarily because of rot. All species not having 1/3 or more of its gross board-foot volume meeting size, soundness, and grade requirements, and over 1/2 of the cubic-foot cull is rotten or unsound.

ITEM 5150 CROWN CLASS (CORE 5.15)

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 20). Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree, which is now dominant due to tree removal, is classified as dominant.

When Collected: All live tally trees $\geq$ 1.0 in DBH

Field width: 1 digit

Values:

1 Open Grown: Trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.

2 Dominant: Trees with crown extending above the general level of the crown cover and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides.

3 Co-dominant: Trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.

4 Intermediate: Trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediates usually have small crowns and are very crowded from the sides.

5 Overtopped: Trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

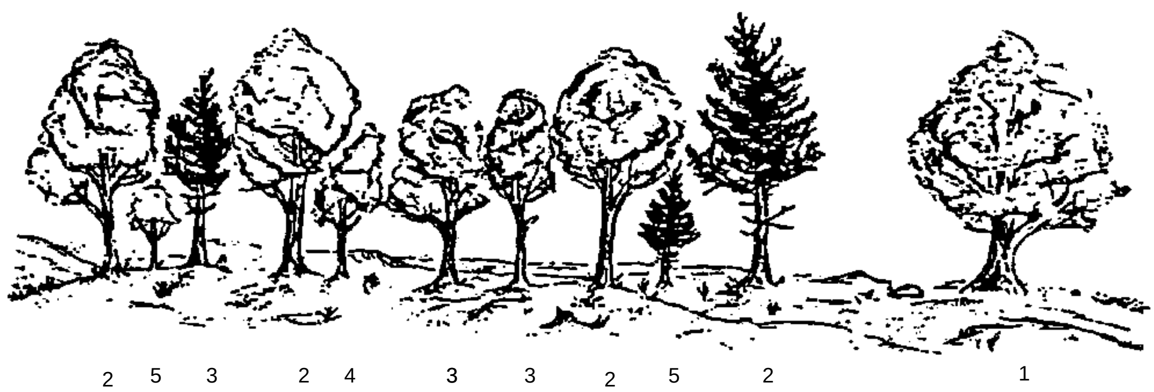


Figure 20. Examples of CROWN CLASS definitions.

ITEM 5170 COMPACTED CROWN RATIO (CORE 5.17)

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 in and larger to the nearest 1 %. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage and is expressed as a percentage of the actual tree length. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2-feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 27).

When collected: All live tally trees ≥ 1.0 in DBH
Field width: 2 digits
Values: 00 to 99

ITEM R504 TREE GRADE

Record the code indicating the grade of the tree. See Appendix 3 for full description of procedures.

When collected: TREE CLASS = 2 and DBH ≥ 11.0 in for hardwoods, DBH ≥ 9.0 in for softwoods
Field width: 1 digit
Values: See Appendix 3

ITEM R502 PERCENT BOARD FOOT CULL

Record the percentage of sound and unsound board-foot volume, to the nearest 1 percent. See Appendix 3 for complete procedures and board foot volume tables.

When collected: TREE CLASS = 2; DBH ≥ 11.0 in for hardwoods or DBH ≥ 9.0 in for softwoods
Field width: 2 digits
Values: 00-67

ITEM 5110 PERCENT ROTTEN/MISSING CULL (CORE 5.11)

Record the percentage of rotten and missing cubic-foot cull volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length. See Appendix 3 for complete procedures and cubic foot volume table.

When collected: All live tally trees > 5.0 in DBH; all mortality trees ≥ 5.0 in DBH and TREE CLASS = 2 or 3
Field width: 2 digits
Values: 00 to 99

ITEM 5120 TOTAL LENGTH (CORE 5.12)

Record the TOTAL LENGTH of the tree, to the nearest 1.0 ft from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees, measure the tallest stem.

When collected: All live tally trees ≥ 1.0 in DBH
Field width: 3 digits
Values: 005 to 400

ITEM 5130 ACTUAL LENGTH (CORE 5.13)

For trees with broken or missing tops. Record the ACTUAL LENGTH of the tree to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. If the top is intact, this item may be omitted on live trees. Forked trees should be treated the same as unforked trees, measure the tallest stem. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk).

When collected: All live tally trees ≥ 1.0 in DBH and all standing dead tally trees ≥ 5.0 in DBH
Field width: 3 digits
Values: 005 to 400

ITEM 5140 LENGTH METHOD (CORE 5.14)
Record the code that indicates the method used to determine tree lengths.

When collected: All live tally trees ≥ 1.0 in DBH and all standing dead tally trees ≥ 5.0 in DBH
Field width: 1 digit
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape)

2 Total length is visually estimated, actual length is measured with an instrument

3 Total and actual lengths are visually estimated

ITEM R505 FUSIFORM/ COMANDRA RUST/ HARDWOOD DIEBACK INCIDENCE
Record the incidence of fusiform, comandra rust and dieback.

When collected: SPECIES = 111, 131, all hardwoods; DBH ≥ 5.0 in DBH
Field width: 1 digit
Values:

Code	Agent	Description/Threshold
0	None	
1	Fusiform, Comandra Rust	SPECIES 111, 131 ONLY: Record only those cankers that occur on the main stem or on a live branch within 12 inches of the stem. Many older galls appear as cankers with sunken rotten centers encircled by callus ridges. Witch's broom is common at galls. Masses of yellow-orange spores in the spring on the galls and canker margins.
2	Dieback	HARDWOODS ONLY: Record if 10% or more of the crown area is affected. Do not code for overtopped trees. Branches dieback from the tips. Just a few branches are affected at first with whole branches dying in the advanced stages. Frequently associated with stress caused by unfavorable environment, especially drought.

ITEM R506 DIEBACK SEVERITY

Record the severity of hardwood crown dieback.

When collected: HARDWOOD DIEBACK INCIDENCE = 2
Field width: 1 digit
Values:

Code	Class in percent	Code	Class in percent
1	10-19	6	60-69
2	20-29	7	70-79
3	30-39	8	80-89
4	40-49	9	90-99
5	50-59		

TREE DAMAGE

Record up to two different damages per tree. Damage is characterized according to three attributes: location of damage, type of damage, and severity of damage. Damages must meet severity thresholds in order to be recorded. See Appendix 3 for full description of procedures.

When collected: All live tally trees ≥ 5.0 in. DBH
Field width:
LOCATION: 1 digit
TYPE: 2 digits
SEVERITY: 1 digit
Values: See Appendix 3

ITEM R511 DAMAGES?

Record the code indicating the presence or absence of damage on all live tally trees.

When collected: Data recorder only; all live tally trees ≥ 5.0 in. DBH
Field width: 1 digit
Values:
0 No (none present)
1 Yes (damage present)

ITEM 5181 DAMAGE LOCATION 1 (CORE 5.18.1)

Record the location on the tree where DAMAGE TYPE 1 is found.

ITEM 5182 DAMAGE TYPE 1 (CORE 5.18.2)

Record the first damage type observed that meets the damage threshold definition in the lowest location.

ITEM 5183 DAMAGE SEVERITY 1 (CORE 5.18.3)

Record the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for DAMAGE TYPE 1. Severity codes vary depending on the type of damage recorded.

ITEM 5184 DAMAGE LOCATION 2 (CORE 5.18.4)
Record the location on the tree where DAMAGE TYPE 2 is found. Follow the same procedures as for DAMAGE LOCATION 1.

ITEM 5185 DAMAGE TYPE 2 (CORE 5.18.5)
Record the second damage type observed that meets the damage threshold definition in the lowest location. Follow the same procedures as for DAMAGE TYPE 1.

ITEM 5186 DAMAGE SEVERITY 2 (CORE 5.18.6)
Record the amount of affected area (above threshold) in DAMAGE LOCATION 2 recorded for DAMAGE TYPE 2. Follow the same procedures as for DAMAGE SEVERITY 1.

ITEM 5190 CAUSE OF DEATH (CORE 5.19)
Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

When Collected: All PAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3
Field width: 2 digits
Values:

10	Insect	60	Vegetation (suppression, competition, vines/kudzu)
20	Disease	70	Unknown/not sure/other
30	Fire	80	Human
40	Animal	90	Physical (hit by falling tree)
50	Weather		

ITEM 5200 MORTALITY YEAR (CORE 5.20)
Record the estimated year that remeasured trees died or were cut. For each remeasured tree that has died or been cut since the previous inventory, record the 4-digit year in which the tree died. Mortality year is also recorded for trees on land that has been converted to a nonforest land use, if it can be determined that a tree died before the land was converted.

When Collected: All PAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3
Field width: 4 digits
Values: 19xx or higher

ITEM 5210 DECAY CLASS (CORE 5.21)

For each standing dead tally tree, 5.0 inches DBH and larger, record the code indicating the tree's stage of decay.

When collected: All standing dead tally trees $\geq$ 5.0 in DBH
Field width: 1 digit
Values: 1-5 Use the following table for guidelines.

Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

Decay stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition	Heartwood condition*
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

ITEM 5220 UTILIZATION CLASS (CORE 5.22)
Record the code to identify cut trees that have been removed from the site.

When Collected: All PRESENT TREE STATUS = 1-3
Field width: 2 digits
Values:

00	Not utilized - can still be found on the site, or, if not actually found on the site, the cruiser estimates that due to past DBH, species, or from other information, that the tree was not removed from the site for use as a product, either commercially or non-commercially.
11	Commercial utilization – some portion of the tree removed for commercial purposes. Commercial uses include sawlogs, pulpwood, veneer logs, poles, and other products such as firewood cut by commercial firewood operations.
12	Non-commercial utilization – some portion of the tree removed for non-commercial purposes. Non-commercial uses include domestic firewood use, barn poles, fence posts, domestic landscaping, rough slabs, etc.

Trees that have been cut above 4.5 ft ("jump-butt") due to a fence or defect, are tallied if still standing at 4.5 ft. If the tree is still alive at DBH, then record TREE STATUS = 1 and then record UTILIZATION = 11 or 12. If it is dead at DBH, then record TREE STATUS = 2 and UTILIZATION = 11 or 12. However, this does NOT apply to naturally swell butted trees where it is normal to cut above 4.5'. Continue to code those trees as removals (TREE STATUS 3) if cut below the diameter point and then code UTILIZATION = 11 or 12.

ITEM 5260 TREE NOTES (CORE 5.26)
Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All live and dead tally trees
Field width: Alphanumeric character field
Values: English language words, phrases and numbers

6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting seedlings within the 6.8 ft radius microplot located 90 degrees and 12.0 ft from each subplot center within each of the four subplots. Conifer seedlings must be at least 0.5 ft in length and less than 1.0 in at DBH in order to qualify for tallying, except longleaf pine must be at least 0.5 in at the root collar. Hardwood seedlings must be at least 1.0 ft in length and less than 1.0 in at DBH in order to qualify for tallying. Planted seedlings must meet the same size requirements as naturally established seedlings.

Seedlings are counted in groups by species and condition class, up to 5 individuals per species. Counts beyond 5 are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. Only count seedlings occurring in accessible forest land condition classes.

ITEM 6010 MICROPLOT NUMBER (CORE 6.1)

Use the procedures outlined in ITEM 4010.

When Collected: All counts of seedlings
Field width: 1 digit
Values: 1-4

ITEM 6030 CONDITION CLASS NUMBER (CORE 6.3)

Use the procedures outlined in Section 2.0.

When Collected: All counts of seedlings
Field width: 1 digit
Values: 1-9

ITEM 6020 SPECIES (CORE 6.2)

Use the procedures outlined in ITEM 5080.

When Collected: All counts of seedlings
Field width: 3 digits
Values: See Appendix 3

ITEM 6040 SEEDLING COUNT (CORE 6.4)

Record the number of seedlings of each species, by condition class. Count up to 5 individuals by species; code 6 if there are more than 5 individuals of any given species in any given condition class. Code species in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. Only count a stump sprout as one seedling. Do NOT count each sprout as a separate seedling.

When Collected: Each accessible forest land condition class on each microplot
Field width: 1 digit
Values:

1 to 5	Exact count
6	More than 5 individuals by species by condition class.

7.0 SITE TREE INFORMATION

Site trees are a measure of site productivity expressed by the height to age relationship of dominant and co-dominant trees. If suitable site trees are available, site tree data are required for every accessible forest land condition class defined on a plot. An individual site tree may be used for more than one condition class where differences in condition classes are not the result of differences in site productivity. For example, when different condition classes are caused solely due to differences in reserved status, owner class, and/or disturbance-related differences in density (e.g., heavily thinned vs. unthinned), a site tree may be used for more than one condition class. When in doubt, do not use a site tree for more than one condition class.

7.1 SITE TREE SELECTION

Select at least 1 site tree for each accessible forest land condition class; select tree from a species common to the condition class being sampled, based on regional or local tree species selection criteria (Appendix 4 lists preferred site tree species by region). Select trees off the subplot where possible. Use only trees that have remained in a dominant or co-dominant crown position throughout their entire life span. If possible, trees should be 5.0 inches in diameter, or larger, and at least 20 years old. Trees that are visibly damaged, trees with ring patterns that exhibit signs of suppression, and trees with rotten cores should be rejected. If there are no acceptable site trees, record that in the plot notes and leave this section blank.

7.2 SITE TREE DATA VARIABLES

R701 SITE TREE NUMBER

Record the number of each site tree collected on the "Sample Location Page."

When collected: Site trees that have an azimuth and distance recorded
Field width: 1 digit
Values: 1-6

ITEM 7021 CONDITION CLASS LIST (CORE 7.2.1)

List all CONDITION CLASSES that the site index data from this tree represent.

When collected: All site trees
Field width: 5 digits
Values: 1 to 9

ITEM 7022 SPECIES (CORE 7.2.2)

Use the same procedures described in Section 5.0 (Appendix 4 lists preferred site tree species by region).

When collected: All site trees
Field width: 3 digits
Values: See Appendix 4

ITEM 7023 DIAMETER (CORE 7.2.3)

Use the same procedures described in Section 5.0.

When Collected: All site trees
Field width: 3 digits (xx.y)
Values: 050 to 300

ITEM 7024 SITE TREE LENGTH (CORE 7.2.4)

With a clinometer or other approved instrument, measure the total length of the site tree from the ground to the top of the tree. Record to the nearest 1.0 ft. SITE TREE LENGTH must be measured; no estimates are permitted on site trees.

When collected: All site trees
Field width: 3 digits
Values: 001 to 175

ITEM 7025 TREE AGE AT DIAMETER (CORE 7.2.5)

Record the tree age as determined by an increment sample. Bore the tree at the point of diameter measurement with an increment borer. Count the rings between the outside edge of the core and the pith. Do not add years to get total age.

When collected: All site trees
Field width: 3 digits
Values: 015 to 120

ITEM 7026 SITE TREE NOTES (CORE 7.2.6)

Record notes pertaining to an individual site tree.

When collected: All site trees as necessary
Field width: alphanumeric character field
Values: English language words, phrases and numbers

ITEM 7027 SUBPLOT NUMBER (CORE OPTIONAL 7.2.7)

Record the subplot number to which the site tree is referenced.

When collected: All site trees
Field width: 1 digit
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

ITEM 7028 AZIMUTH (CORE OPTIONAL 7.2.8)

Record the AZIMUTH from the subplot center on the back of the draw page; sight the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

When collected: Optional
Field width: 3 digits
Values: 001 to 360

ITEM 7029 HORIZONTAL DISTANCE (CORE OPTIONAL 7.2.9)

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 ft, from the subplot center to the pith of the tree at the base on the back of the draw page.

When Collected: Optional
Field width: 4 digits (xxx.y)
Values: 000.1 to 200.0

8.0 NONFOREST/DENIED ACCESS/ HAZARDOUS/ INTENSIFICATION PLOTS

8.1 OVERVIEW OF NONFOREST/ DENIED ACCESS/ HAZARDOUS PLOTS

This section describes field procedures for attempted, field-visited nonforest, denied access, and hazardous plots. These plots are of interest from the standpoint that they may once have been forest, or that they may revert to forest or become accessible in the future. Thus, they are monitored to account for lands that move into and out of the forest land base. Only basic plot identification data are recorded on these plots.

A plot is considered nonforest if no part of it is currently located in forest land (CURRENT PLOT STATUS = 1). A plot is inaccessible if access is prevented to the entire plot by the land owner or because of some hazardous situation (cliffs, unexploded shells, marijuana crop on plot, etc).

No ground plots are established at nonforest or inaccessible sample locations. If a forest plot has been converted to nonforest or becomes inaccessible, the previous data are reconciled and an attempt is made to visit the plot during the next inventory. If a nonforest plot becomes forest or access is gained to a previously inaccessible plot, a new forest ground plot is installed. All nonforest and inaccessible plots are visited if there is any reasonable chance that they might include some forest land condition class.

8.2 PROCEDURES FOR NONFOREST/ DENIED ACCESS/ HAZARDOUS PLOTS

Trees on previously forest land plots will be reconciled at data processing. There is a distinction between plots that have been clearcut, and plots that have been converted to another land use. A clearcut plot is considered to be forest land until it is actively converted to another land use. The procedures in this section do not apply to clearcuts unless and until the land is converted to a nonforest use. Additional information concerning land use classifications is contained in Section 2.3.

In cases where a plot is inaccessible, but obviously contains no forest land, assign the plot to the appropriate nonforest land use. Access-denied and hazardous land uses are utilized only if there is a possibility the plot contains forest.
It is not necessary to establish or maintain any starting points, witness trees, boundaries, etc., on nonforest or inaccessible plots. However, if the course to plot is installed to determine if the plot samples an accessible forest land condition, then fill out the Sample Location Reference Page.

8.3 DATA RECORDED ON NONFOREST/ DENIED ACCESS/ HAZARDOUS PLOTS

Use the same procedures described in Section 1.0 to collect the following data items on all nonforest/ denied access/ hazardous plots:

ITEM 1010 STATE

ITEM 1020 COUNTY

ITEM 1030 PLOT NUMBER

ITEM 1040 SAMPLE KIND

ITEM 1050 MANUAL VERSION

ITEM 1060 CURRENT DATE

ITEM R101 PAST DATE (SK = 2 OR 9)

ITEM 1160 QA STATUS

ITEM 1170 CREW TYPE

ITEM R102 CRUISER NUMBER

ITEM 1803 GPS UNIT

ITEM 1804 GPS SERIAL NUMBER

ITEM 1806 LATITUDE

ITEM 1807 LONGITUDE

ITEM 1815 GPS ERROR

ITEM 1816 NUMBER OF READINGS

ITEM 1190 PLOT-LEVEL NOTES

Use the same procedures described in Section 2.0 to collect the following data items on all nonforest/ denied access/ hazardous plots:

ITEM 2425 PRESENT LAND USE AT PLOT CENTER

ITEM 2202 PRESENT CONDITION STATUS AT PLOT CENTER

ITEM 2424 NEW PAST LAND USE AT PLOT CENTER (SK = 2 OR 9)

ITEM R202 NEW PAST CONDITION STATUS AT PLOT CENTER (SK = 2 OR 9)

8.4 OVERVIEW OF INTENSIFICATION PLOTS

Intensifications are additional ground checks of the photo interpretation completed in the office. Detailed plot, condition, and tree data are not collected. These additional plots are used to strengthen the forest area adjustment and are numbered in the 4000 series.

8.5 PROCEDURES FOR INTENSIFICATION PLOTS

Like all other plots, intensification plots are photo interpreted in the office and ground checked in the field. The photo interpretation (PI) categories are forest, nonforest, census water, and noncensus water. The land use codes recorded in the field are the same as the standard production plots (see Section 2.7). Do not move the pinprick on intensification plots or change the PI category on any plot. Photo work and GPS data are not required.

8.6 DATA RECORDED ON INTENSIFICATION PLOTS

Collect the same data outlined in Section 8.3 for nonforest/denied access/ hazardous plots, except SAMPLE KIND, PAST DATE, NEW PAST CONDITION STATUS, and GPS data are not required. Record land use, date, cruiser code and cruiser initials on the back of the new photo.

REQUIRED ITEMS	STATE	COUNTY	PLOT NUMBER	SAMPLE KIND	MANUAL VERSION	CURRENT DATE	PAST DATE	QA STATUS	CREW TYPE	CRUISER NUMBER	PRESENT LAND USE	PRESENT CONDITION STATUS	NEW PAST LAND USE AT PC	NEW PAST CONDITION STATUS	GPS UNIT	GPS SERIAL NUMBER	LATITUDE	LONGITUDE	GPS ERROR	NUMBER OF READINGS	PLOT LEVEL NOTES
NF/DA/HAZ	X	X	X	1	X	X		X	X	X	X	X			X	X	X	X	X	X	X
NF/DA/HAZ	X	X	X	2/9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
INT	X	X	X		X	X		X	X	X	X	X									X

APPENDIX 1

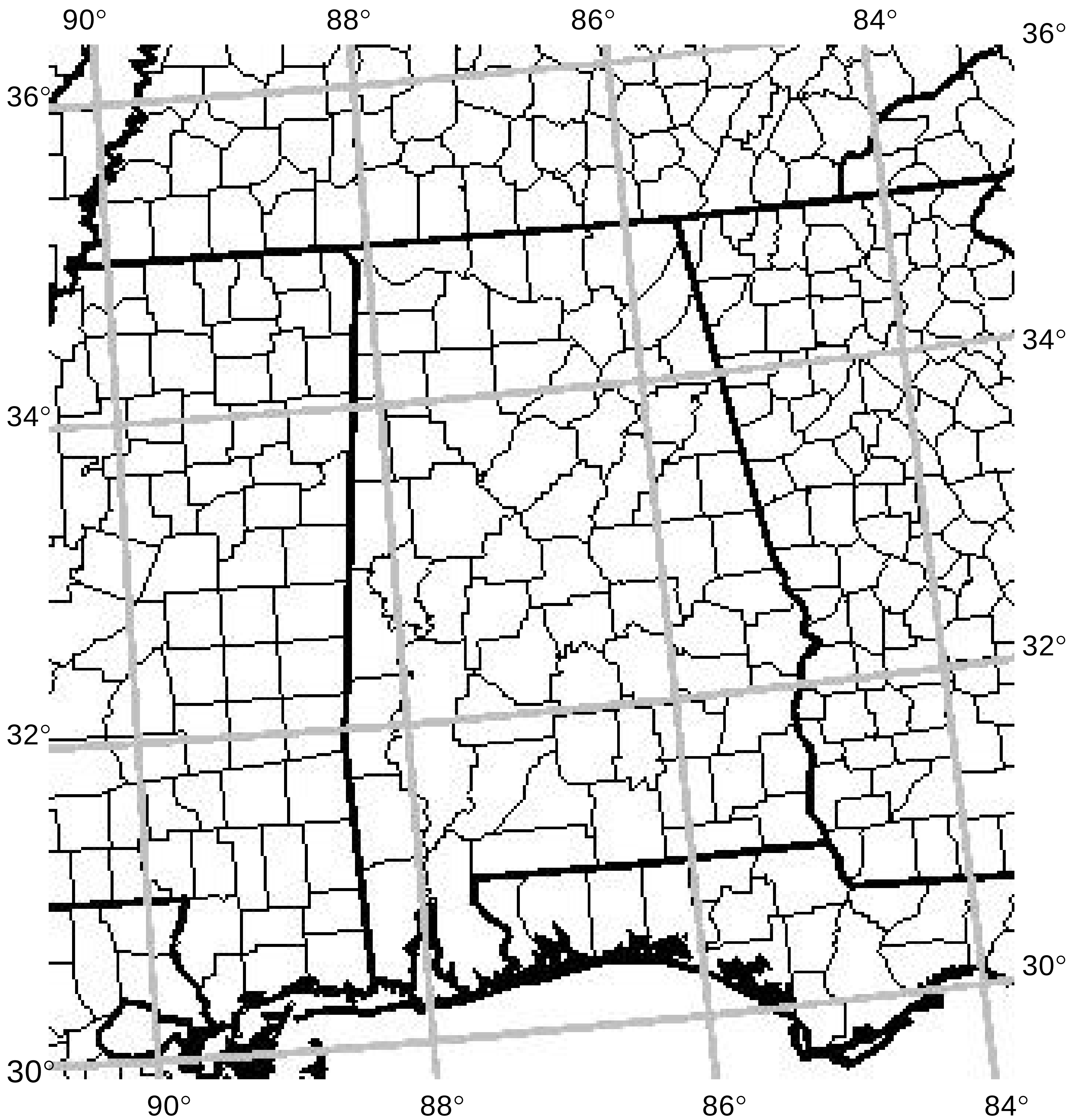
PLOT LEVEL DATA

ALABAMA - 01

Autauga	001
Baldwin	003
Barbour	005
Bibb	007
Blount	009
Bullock	011
Butler	013
Calhoun	015
Chambers	017
Cherokee	019
Chilton	021
Choctaw	023
Clarke	025
Clay	027
Cleburne	029
Coffee	031
Colbert	033
Conecuh	035
Coosa	037
Covington	039
Crenshaw	041
Cullman	043
Dale	045
Dallas	047
De Kalb	049
Elmore	051
Escambia	053
Etowah	055
Fayette	057
Franklin	059
Geneva	061
Greene	063
Hale	065
Henry	067
Houston	069
Jackson	071
Jefferson	073
Lamar	075
Lauderdale	077
Lawrence	079
Lee	081
Limestone	083
Lowndes	085
Macon	087
Madison	089
Marengo	091
Marion	093
Marshall	095
Mobile	097
Monroe	099
Pickens	107
Pike	109
Russell	113
Mongomery	101
Morgan	103
Perry	105
Randolph	111
St. Clair	115
Shelby	117
Sumter	119
Talladega	121
Tallapoosa	123
Tuscaloosa	125
Walker	127
Washington	129
Wilcox	131
Winston	133

Alabama Counties

GPS Coordinate Grid

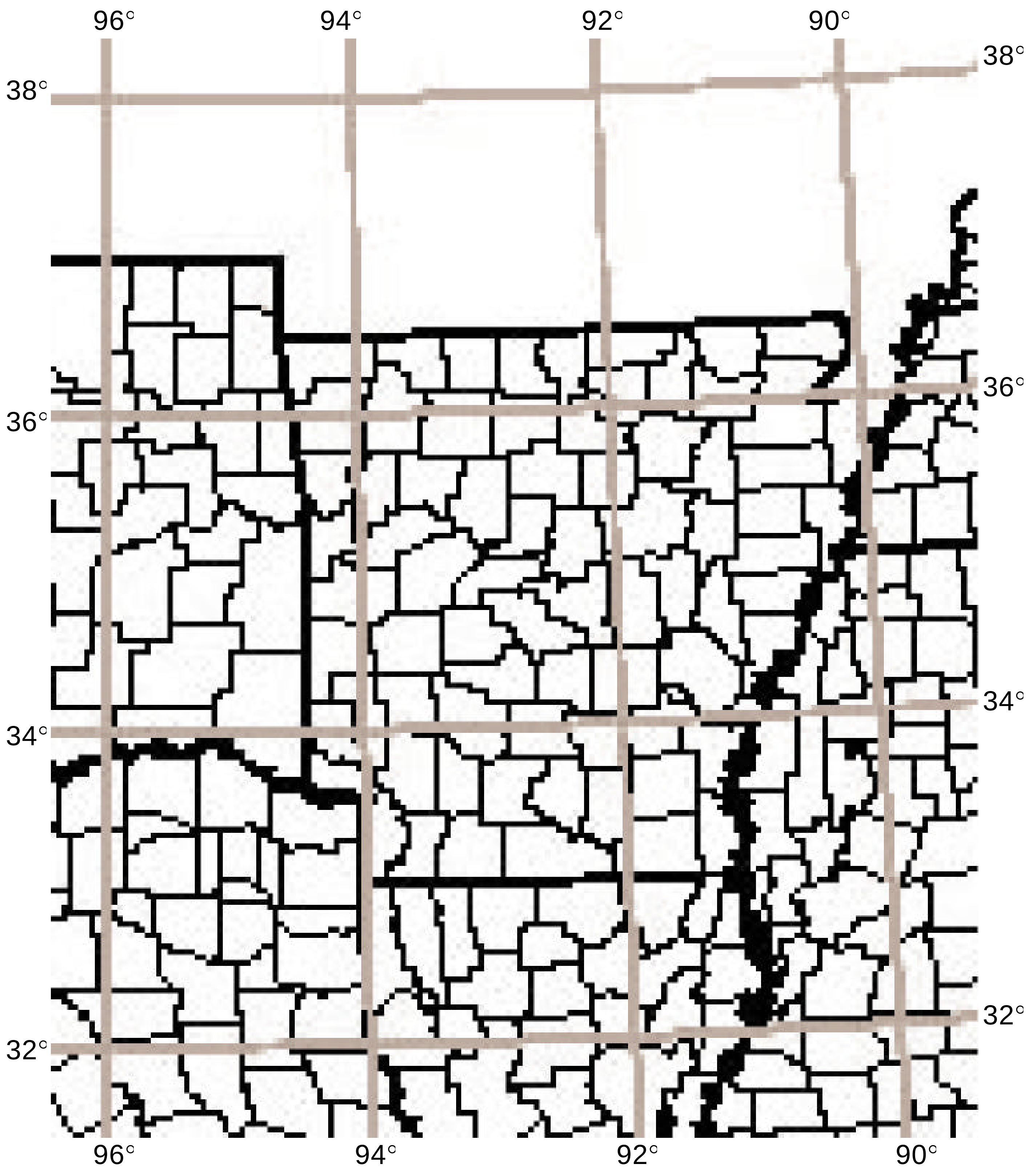


ARKANSAS - 05

Arkansas	001	Lee	077
Ashley	003	Lincoln	079
Baxter	005	Little River	081
Benton	007	Logan	083
Boone	009	Lonoke	085
Bradley	011	Madison	087
Calhoun	013	Marion	089
Carroll	015	Miller	091
Chicot	017	Mississippi	093
Clark	019	Monroe	095
Clay	021	Montgomery	097
Cleburne	023	Nevada	099
Cleveland	025	Newton	101
Columbia	027	Ouachita	103
Conway	029	Perry	105
Craighead	031	Phillips	107
Crawford	033	Pike	109
Crittenden	035	Poinsett	111
Cross	037	Polk	113
Dallas	039	Pope	115
Desha	041	Prairie	117
Drew	043	Pulaski	119
Faulkner	045	Randolph	121
Franklin	047	St. Francis	123
Fulton	049	Saline	125
Garland	051	Scott	127
Grant	053	Searcy	129
Greene	055	Sebastian	131
Hempstead	057	Sevier	133
Hot Spring	059	Sharp	135
Howard	061	Stone	137
Independence	063	Union	139
Izard	065	Van Buren	141
Jackson	067	Washington	143
Jefferson	069	White	145
Johnson	071	Woodruff	147
Lafayette	073	Yell	149
Lawrence	075		

Arkansas Counties

GPS Coordinate Grid

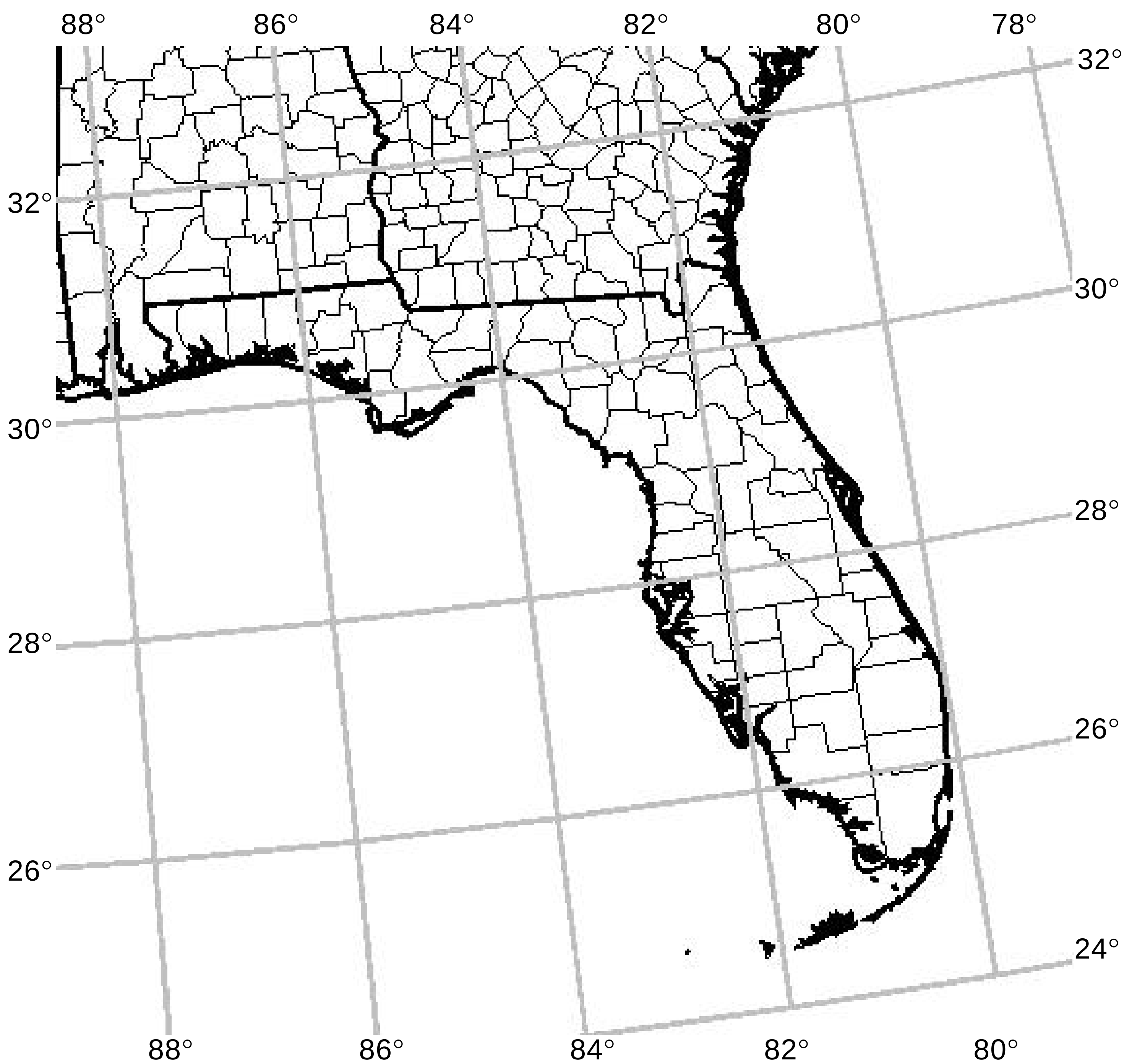


FLORIDA - 12

Alachua	001	Lake	069
Baker	003	Lee	071
Bay	005	Leon	073
Bradford	007	Levy	075
Brevard	009	Liberty	077
Broward	011	Madison	079
Calhoun	013	Manatee	081
Charlotte	015	Marion	083
Citrus	017	Martin	085
Clay	019	Monroe	087
Collier	021	Nassau	089
Columbia	023	Okaloosa	091
Dade	025	Okeechobee	093
De Soto	027	Orange	095
Dixie	029	Osceola	097
Duval	031	Palm Beach	099
Escambia	033	Pasco	101
Flagler	035	Pinellas	103
Franklin	037	Polk	105
Gadsden	039	Putnam	107
Gilchrist	041	St. Johns	109
Glades	043	St. Lucie	111
Gulf	045	Santa Rosa	113
Hamilton	047	Sarasota	115
Hardee	049	Seminole	117
Hendry	051	Sumter	119
Hernando	053	Suwannee	121
Highlands	055	Taylor	123
Hillsborough	057	Union	125
Holmes	059	Volusia	127
Indian River	061	Wakulla	129
Jackson	063	Walton	131
Jefferson	065	Washington	133
Lafayette	067		

Florida Counties

GPS Coordinate Grid



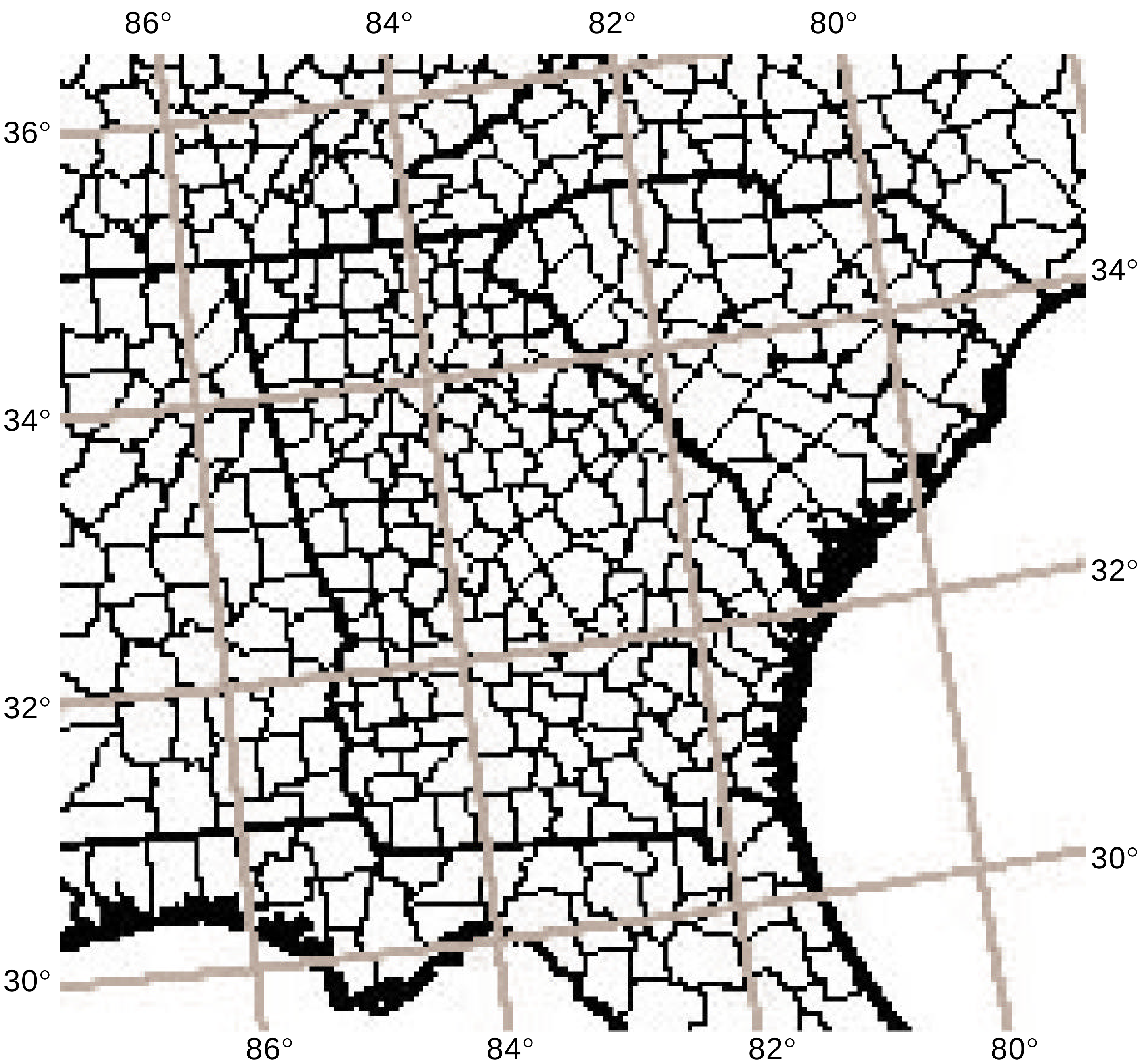
GEORGIA - 13

Appling	001	Emanuel	107
Atkinston	003	Evans	109
Bacon	005	Fannin	111
Baker	007	Fayette	113
Baldwin	009	Floyd	115
Banks	011	Forsyth	117
Barrow	013	Franklin	119
Bartow	015	Fulton	121
Ben Hill	017	Gilmer	123
Berrien	019	Glascock	125
Bibb	021	Glynn	127
Bleckley	023	Gordon	129
Brantley	025	Grady	131
Brooks	027	Greene	133
Bryan	029	Gwinnett	135
Bulloch	031	Habersham	137
Burke	033	Hall	139
Butts	035	Hancock	141
Calhoun	037	Haralson	143
Camden	039	Harris	145
Candler	043	Hart	147
Carroll	045	Heard	149
Catoosa	047	Henry	151
Charlton	049	Houston	153
Chatham	051	Irwin	155
Chattahoochee	053	Jackson	157
Chattooga	055	Jasper	159
Cherokee	057	Jeff Davis	161
Clarke	059	Jefferson	163
Clay	061	Jenkins	165
Clayton	063	Johnson	167
Clinch	065	Jones	169
Cobb	067	Lamar	171
Coffee	069	Lanier	173
Colquitt	071	Laurens	175
Columbia	073	Lee	177
Cook	075	Liberty	179
Coweta	077	Lincoln	181
Crawford	079	Long	183
Crisp	081	Lowndes	185
Dade	083	Lumpkin	187
Dawson	085	Mc Duffie	189
Decatur	087	Mc Intosh	191
De Kalb	089	Macon	193
Dodge	091	Madison	195
Dooly	093	Marion	197
Dougherty	095	Meriwether	199
Douglas	097	Miller	201
Early	099	Mitchell	205
Echols	101	Monroe	207
Effingham	103	Montgomery	209
Elbert	105	Morgan	211

Murray	213	Taylor	269
Muscogee	215	Telfair	271
Newton	217	Terrell	273
Oconee	219	Thomas	275
Oglethorpe	221	Tift	277
Paulding	223	Toombs	279
Peach	225	Towns	281
Pickens	227	Treutlen	283
Pierce	229	Troup	285
Pike	231	Turner	287
Polk	233	Twiggs	289
Pulaski	235	Union	291
Putnam	237	Upson	293
Quitman	239	Walker	295
Rabun	241	Walton	297
Randolph	243	Ware	299
Richmond	245	Warren	301
Rockdale	247	Washington	303
Schley	249	Wayne	305
Screven	251	Webster	307
Seminole	253	Wheeler	309
Spalding	255	White	311
Stephens	257	Whitfield	313
Stewart	259	Wilcox	315
Sumter	261	Wilkes	317
Talbot	263	Wilkinson	319
Taliaferro	265	Worth	321
Tattnall	267		

Georgia Counties

GPS Coordinate Grid

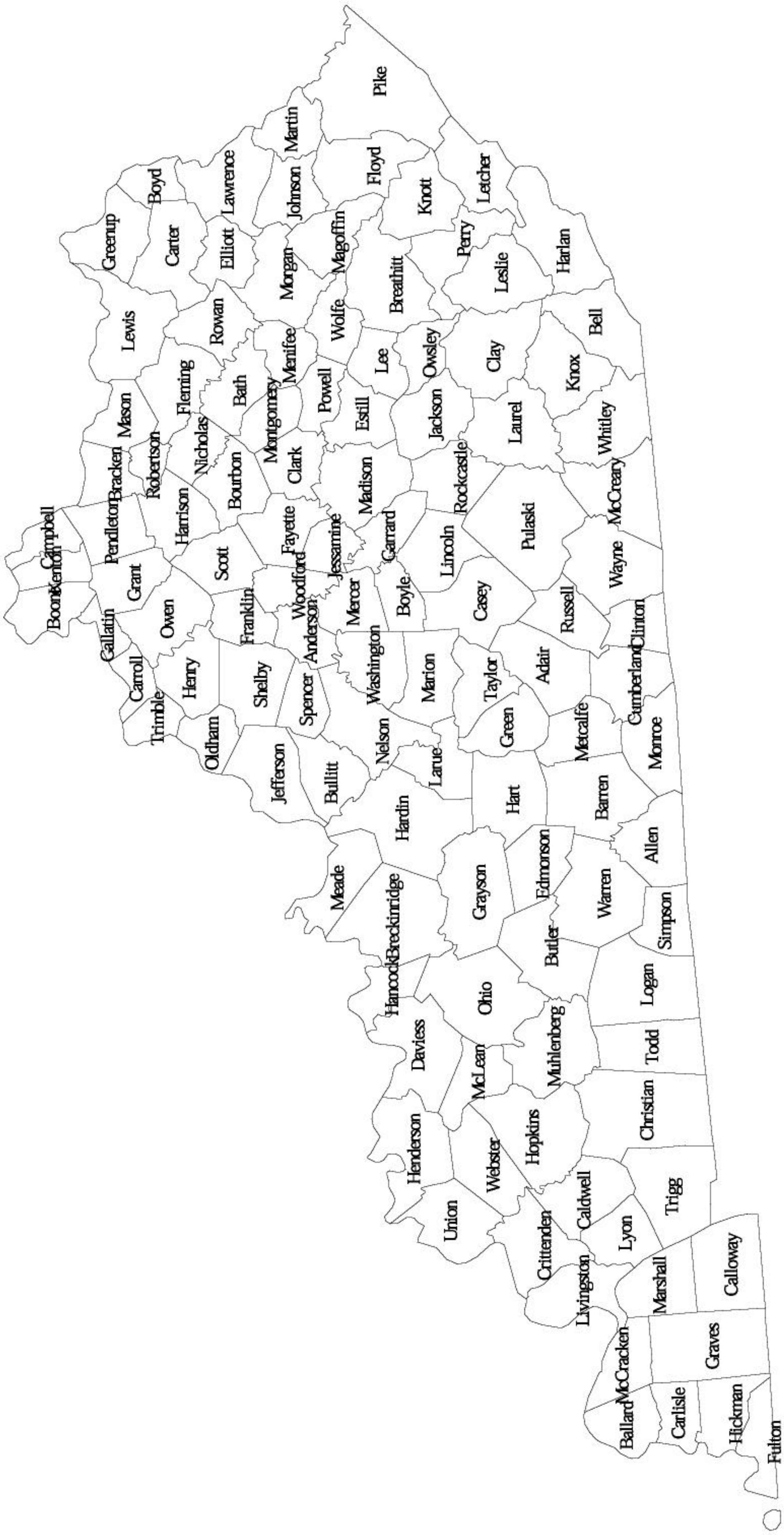


KENTUCKY - 21

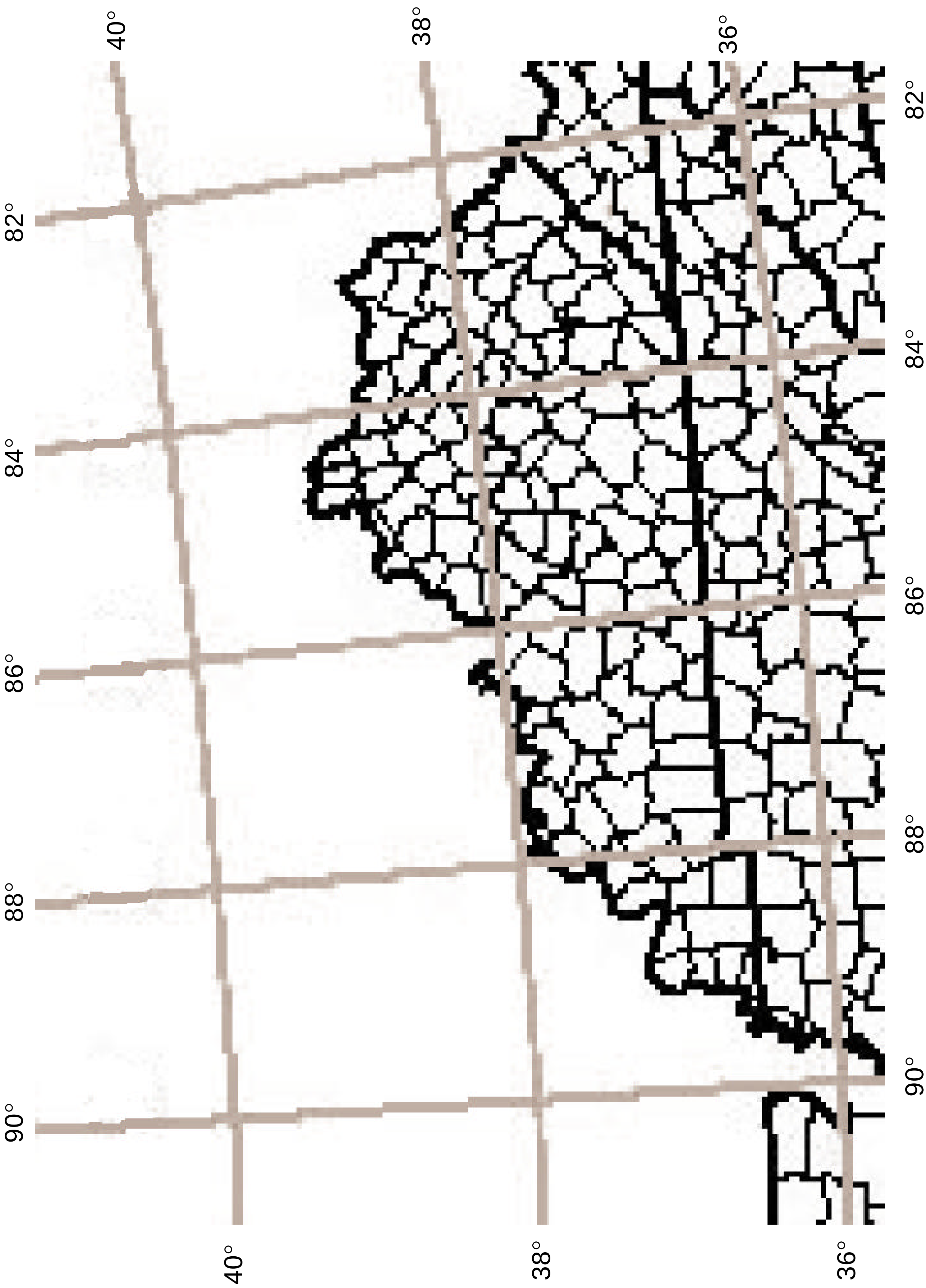
Adair	001	Hickman	105
Allen	003	Hopkins	107
Anderson	005	Jackson	109
Ballard	007	Jefferson	111
Barren	009	Jessamine	113
Bath	011	Johnson	115
Bell	013	Kenton	117
Boone	015	Knott	119
Bourbon	017	Knox	121
Boyd	019	Larue	123
Boyle	021	Laurel	125
Bracken	023	Lawrence	127
Breathitt	025	Lee	129
Breckinridge	027	Leslie	131
Bullitt	029	Letcher	133
Butler	031	Lewis	135
Caldwell	033	Lincoln	137
Calloway	035	Livingston	139
Campbell	037	Logan	141
Carlisle	039	Lyon	143
Carroll	041	McCracken	145
Carter	043	McCreary	147
Casey	045	McLean	149
Christian	047	Madison	151
Clark	049	Magoffin	153
Clay	051	Marion	155
Clinton	053	Marshall	157
Crittenden	055	Martin	159
Cumberland	057	Mason	161
Daviess	059	Meade	163
Edmonson	061	Menifee	165
Elliott	063	Mercer	167
Estill	065	Metcalfe	169
Fayette	067	Monroe	171
Fleming	069	Montgomery	173
Floyd	071	Morgan	175
Franklin	073	Muhlenberg	177
Fulton	075	Nelson	179
Gallatin	077	Nicholas	181
Garrard	079	Ohio	183
Grant	081	Oldham	185
Graves	083	Owen	187
Grayson	085	Owsley	189
Green	087	Pendleton	191
Greenup	089	Perry	193
Hancock	091	Pike	195
Hardin	093	Powell	197
Harlan	095	Pulaski	199
Harrison	097	Robertson	201
Hart	099	Rockcastle	203
Henderson	101	Rowan	205
Henry	103	Russell	207

Scott	209	Union	225
Shelby	211	Warren	227
Simpson	213	Washington	229
Spencer	215	Wayne	231
Taylor	217	Webster	233
Todd	219	Whitley	235
Trigg	221	Wolfe	237
Trimble	223	Woodford	239

Kentucky Counties



GPS Coordinate Grid

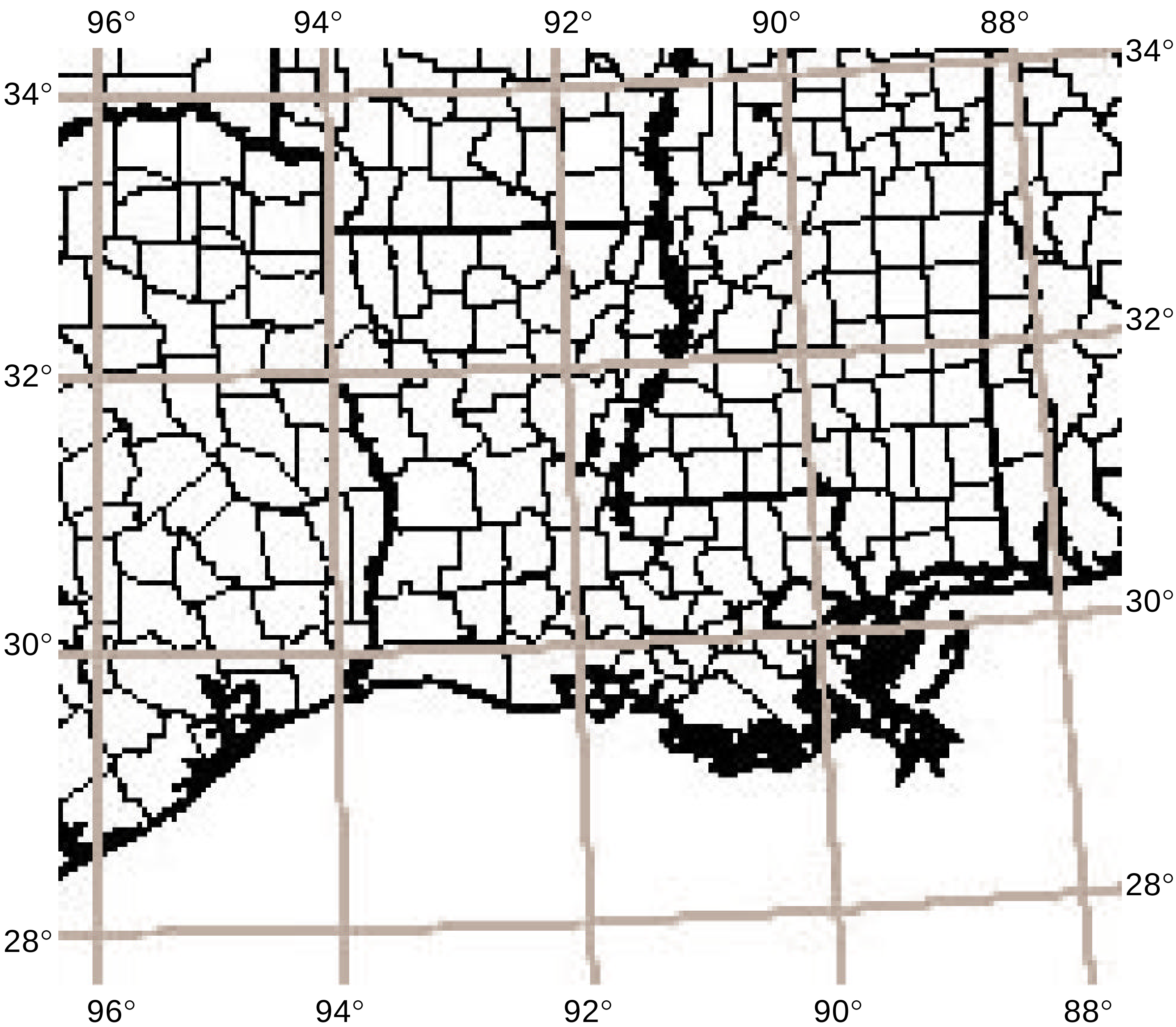


LOUISIANA - 22

Acadia	001	Madison	065
Allen	003	Morehouse	067
Ascension	005	Natchitoches	069
Assumption	007	Orleans	071
Avoyelles	009	Ouachita	073
Beauregard	011	Plaquemines	075
Bienville	013	Pointe Coupee	077
Bossier	015	Rapides	079
Caddo	017	Red River	081
Calcasieu	019	Richland	083
Caldwell	021	Sabine	085
Cameron	023	St. Bernard	087
Catahoula	025	St. Charles	089
Claiborne	027	St. Helena	091
Concordia	029	St. James	093
De Soto	031	St. John the Baptist	095
East Baton Rouge	033	St. Landry	097
East Carroll	035	St. Martin	099
East Feliciana	037	St. Mary	101
Evangeline	039	St. Tammany	103
Franklin	041	Tangipahoa	105
Grant	043	Tensas	107
Iberia	045	Terrebonne	109
Iberville	047	Union	111
Jackson	049	Vermilion	113
Jefferson	051	Vernon	115
Jefferson Davis	053	Washington	117
Lafayette	055	Webster	119
LaFourche	057	West Baton Rouge	121
La Salle	059	West Carroll	123
Lincoln	061	West Feliciana	125
Livingston	063	Winn	127

Louisiana Counties

GPS Coordinate Grid

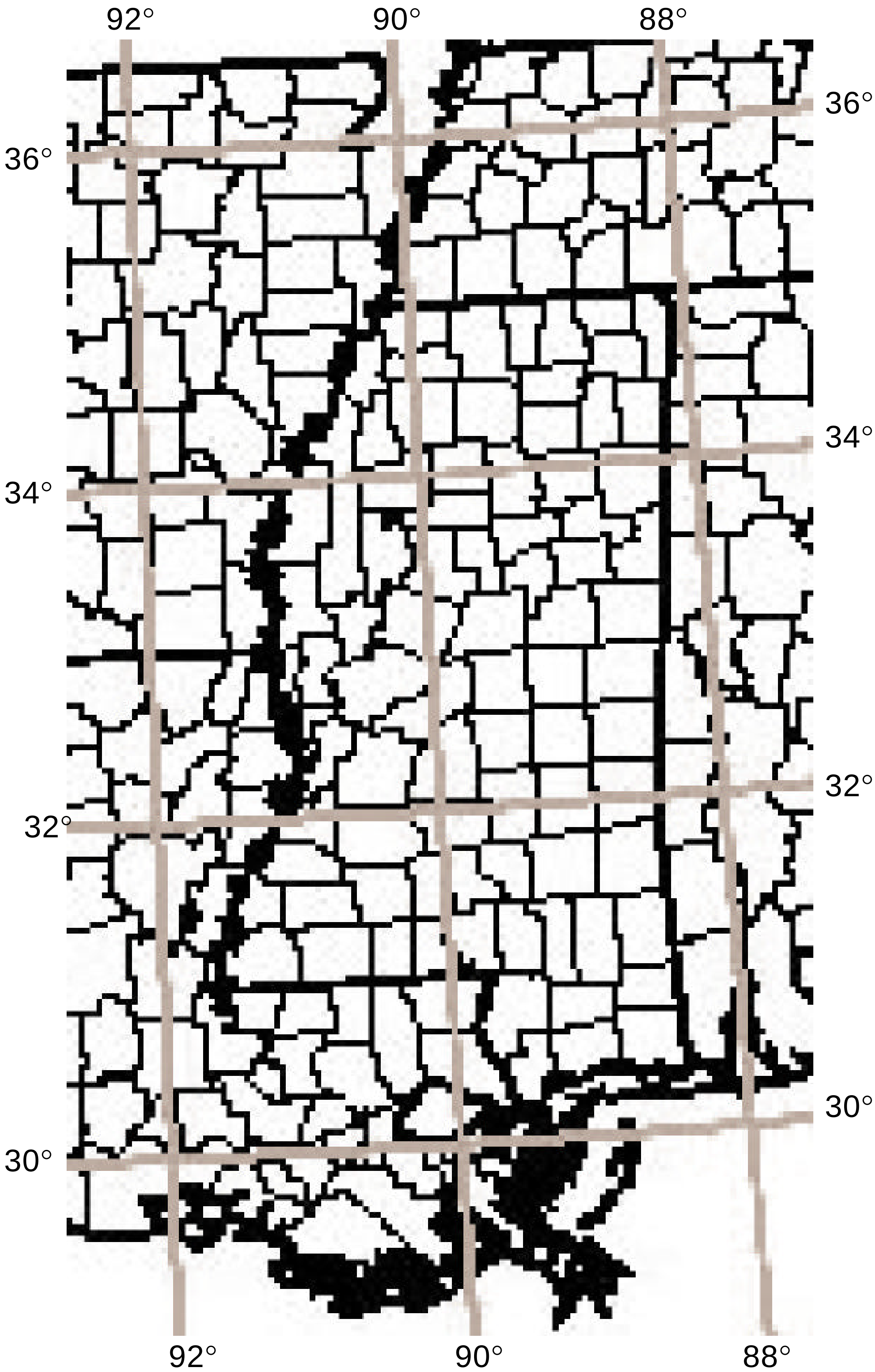


MISSISSIPPI - 28

Adams	001	Leflore	083
Alcorn	003	Lincoln	085
Amite	005	Lowndes	087
Attala	007	Madison	089
Benton	009	Marion	091
Bolivar	011	Marshall	093
Calhoun	013	Monroe	095
Carroll	015	Montgomery	097
Chickasaw	017	Neshoba	099
Choctaw	019	Newton	101
Claiborne	021	Noxubee	103
Clarke	023	Oktibbeha	105
Clay	025	Panola	107
Coahoma	027	Pearl River	109
Copiah	029	Perry	111
Covington	031	Pike	113
De Soto	033	Pontotoc	115
Forrest	035	Prentiss	117
Franklin	037	Quitman	119
George	039	Rankin	121
Greene	041	Scott	123
Grenada	043	Sharkey	125
Hancock	045	Simpson	127
Harrison	047	Smith	129
Hinds	049	Stone	131
Holmes	051	Sunflower	133
Humphreys	053	Tallahatchie	135
Issaquena	055	Tate	137
Itawamba	057	Tippah	139
Jackson	059	Tishomingo	141
Jasper	061	Tunica	143
Jefferson	063	Union	145
Jefferson Davis	065	Walthall	147
Jones	067	Warren	149
Kemper	069	Washington	151
Lafayette	071	Wayne	153
Lamar	073	Webster	155
Lauderdale	075	Wilkinson	157
Lawrence	077	Winston	159
Leake	079	Yalobusha	161
Lee	081	Yazoo	163

Mississippi Counties

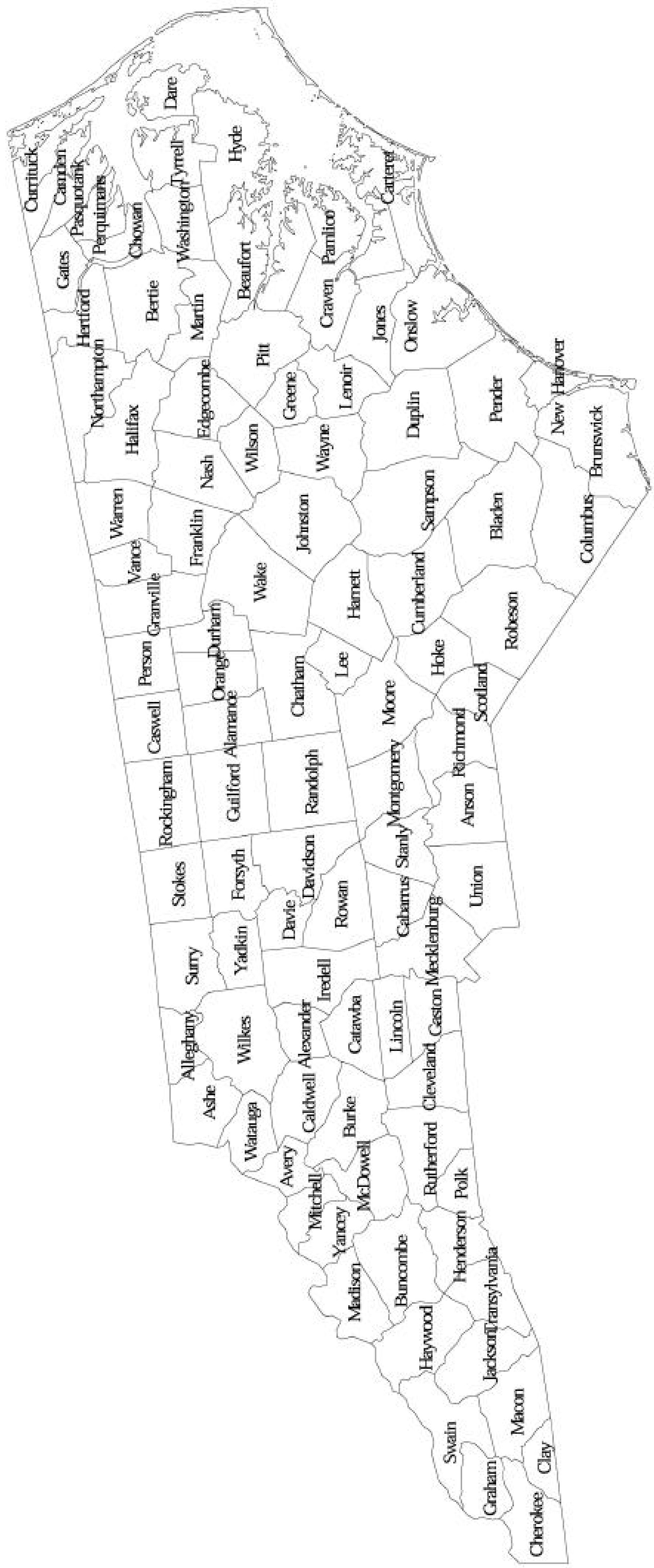
GPS Coordinate Grid



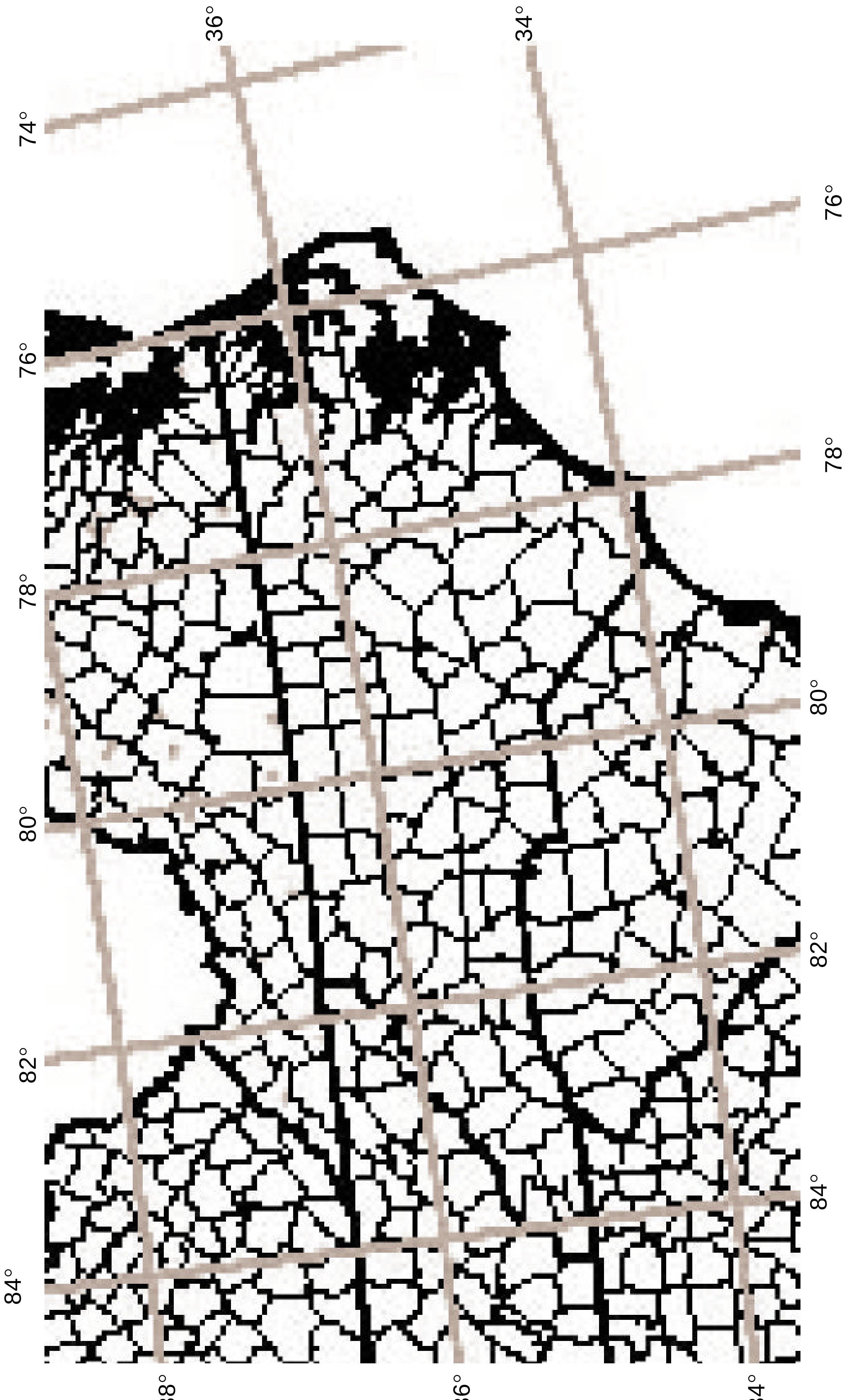
NORTH CAROLINA - 37

Alamance	001	Johnston	101
Alexander	003	Jones	103
Alleghany	005	Lee	105
Anson	007	Lenoir	107
Ashe	009	Lincoln	109
Avery	011	McDowell	111
Beaufort	013	Macon	113
Bertie	015	Madison	115
Bladen	017	Martin	117
Brunswick	019	Mecklenburg	119
Buncombe	021	Mitchell	121
Burke	023	Montgomery	123
Cabarrus	025	Moore	125
Caldwell	027	Nash	127
Camden	029	New Hanover	129
Carteret	031	Northhampton	131
Caswell	033	Onslow	133
Catawba	035	Orange	135
Chatham	037	Pamlico	137
Cherokee	039	Pasquotank	139
Chowan	041	Pender	141
Clay	043	Perquimans	143
Cleveland	045	Person	145
Columbus	047	Pitt	147
Craven	049	Polk	149
Cumberland	051	Randolph	151
Currituck	053	Richmond	153
Dare	055	Robeson	155
Davidson	057	Rockingham	157
Davie	059	Rowan	159
Duplin	061	Rutherford	161
Durham	063	Sampson	163
Edgecombe	065	Scotland	165
Forsyth	067	Stanly	167
Franklin	069	Stokes	169
Gaston	071	Surry	171
Gates	073	Swain	173
Graham	075	Transylvania	175
Granville	077	Tyrrell	177
Greene	079	Union	179
Guilford	081	Vance	181
Halifax	083	Wake	183
Harnett	085	Warren	185
Haywood	087	Washington	187
Henderson	089	Watauga	189
Hertford	091	Wayne	191
Hoke	093	Wilkes	193
Hyde	095	Wilson	195
Iredell	097	Yadkin	197
Jackson	099	Yancey	199

North Carolina Counties



GPS Coordinate Grid

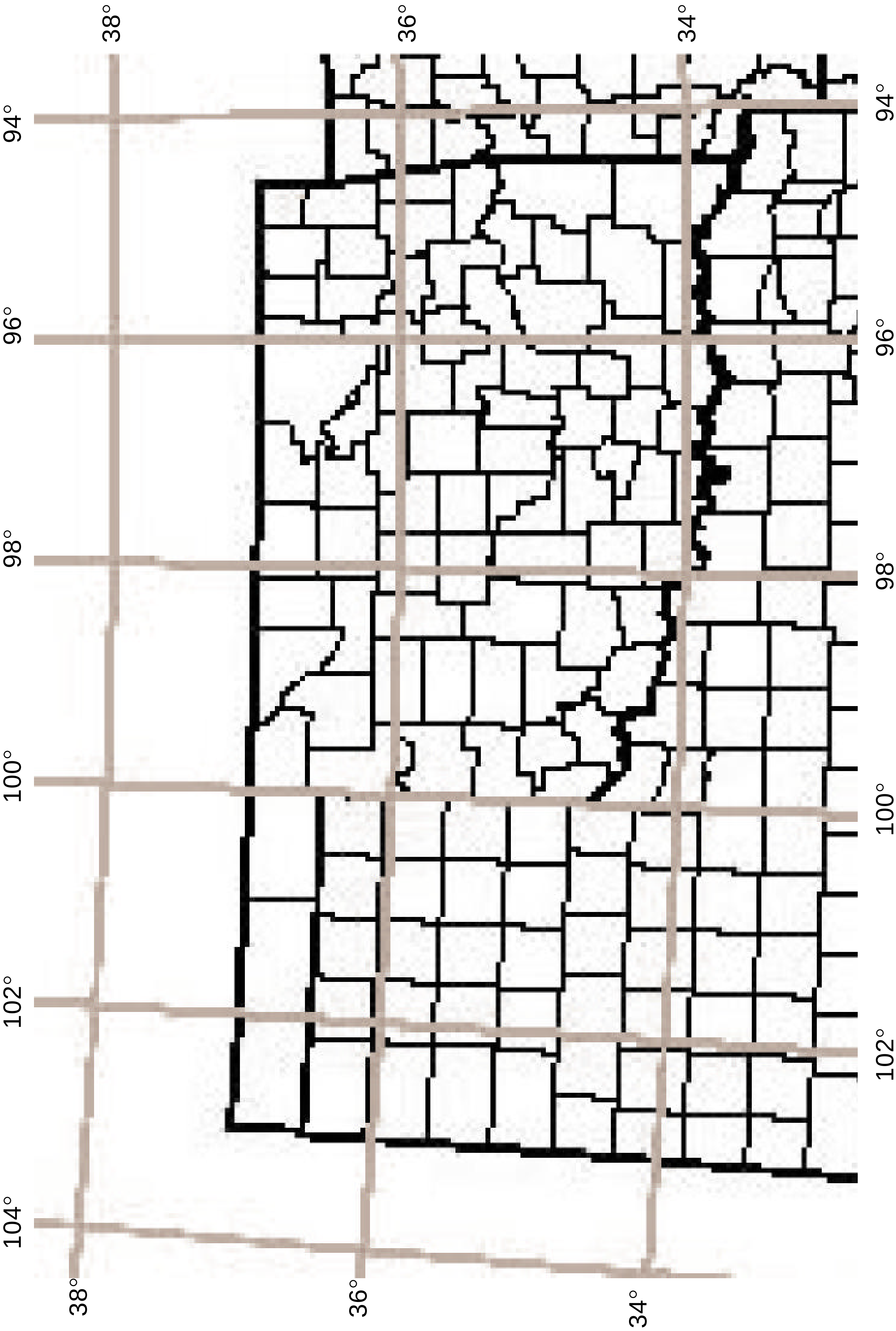


OKLAHOMA - 40

Adair	001	Le Flore	079
Alfalfa	003	Lincoln	081
Atoka	005	Logan	083
Beaver	007	Love	085
Beckham	009	McClain	087
Blaine	011	McCurtain	089
Bryan	013	McIntosh	091
Caddo	015	Major	093
Canadian	017	Marshall	095
Carter	019	Mayes	097
Cherokee	021	Murray	099
Choctaw	023	Muskogee	101
Cimarron	025	Noble	103
Cleveland	027	Nowata	105
Coal	029	Okfuskee	107
Comanche	031	Oklahoma	109
Cotton	033	Okmulgee	111
Craig	035	Osage	113
Creek	037	Ottawa	115
Custer	039	Pawnee	117
Delaware	041	Payne	119
Dewey	043	Pittsburg	121
Ellis	045	Pontotoc	123
Garfield	047	Pottawatomie	125
Garvin	049	Pushmataha	127
Grady	051	Roger Mills	129
Grant	053	Rogers	131
Greer	055	Seminole	133
Harmon	057	Sequoyah	135
Harper	059	Stephens	137
Haskell	061	Texas	139
Hughes	063	Tillman	141
Jackson	065	Tulsa	143
Jefferson	067	Wagoner	145
Johnston	069	Washington	147
Kay	071	Washita	149
Kingfisher	073	Woods	151
Kiowa	075	Woodward	153
Latimer	077		

Oklahoma Counties

GPS Coordinate Grid

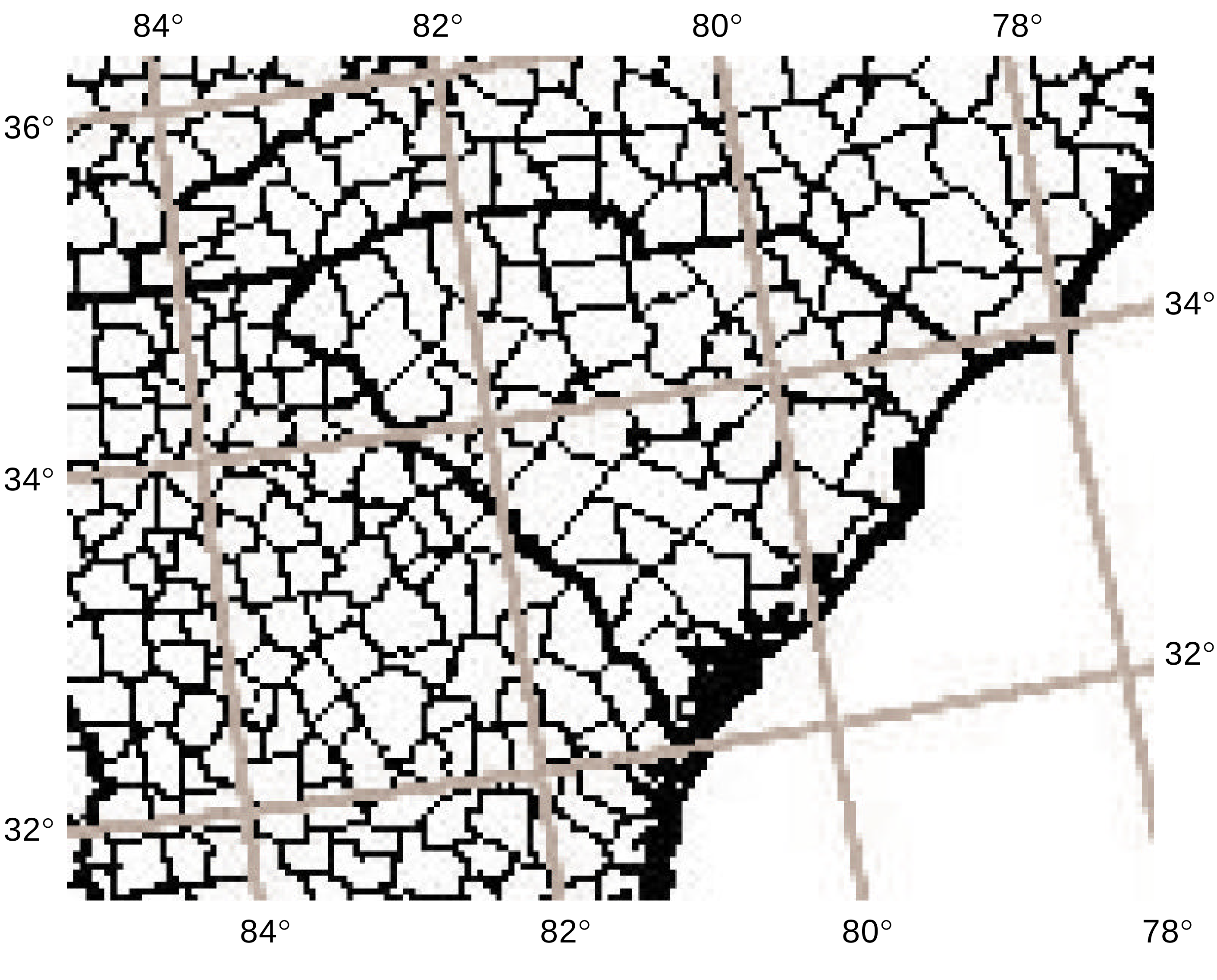


SOUTH CAROLINA – 45

Abbeville	001	Greenwood	047
Aiken	003	Hampton	049
Allendale	005	Horry	051
Anderson	007	Jasper	053
Bamberg	009	Kershaw	055
Barnwell	011	Lancaster	057
Beaufort	013	Laurens	059
Berkeley	015	Lee	061
Calhoun	017	Lexington	063
Charleston	019	Mc Cormick	065
Cherokee	021	Marion	067
Chester	023	Marlboro	069
Chesterfield	025	Newberry	071
Clarendon	027	Oconee	073
Colleton	029	Orangeburg	075
Darlington	031	Pickens	077
Dillon	033	Richland	079
Dorchester	035	Saluda	081
Edgefield	037	Spartanburg	083
Fairfield	039	Sumter	085
Florence	041	Union	087
Georgetown	043	Williamsburg	089
Greenville	045	York	091

South Carolina Counties

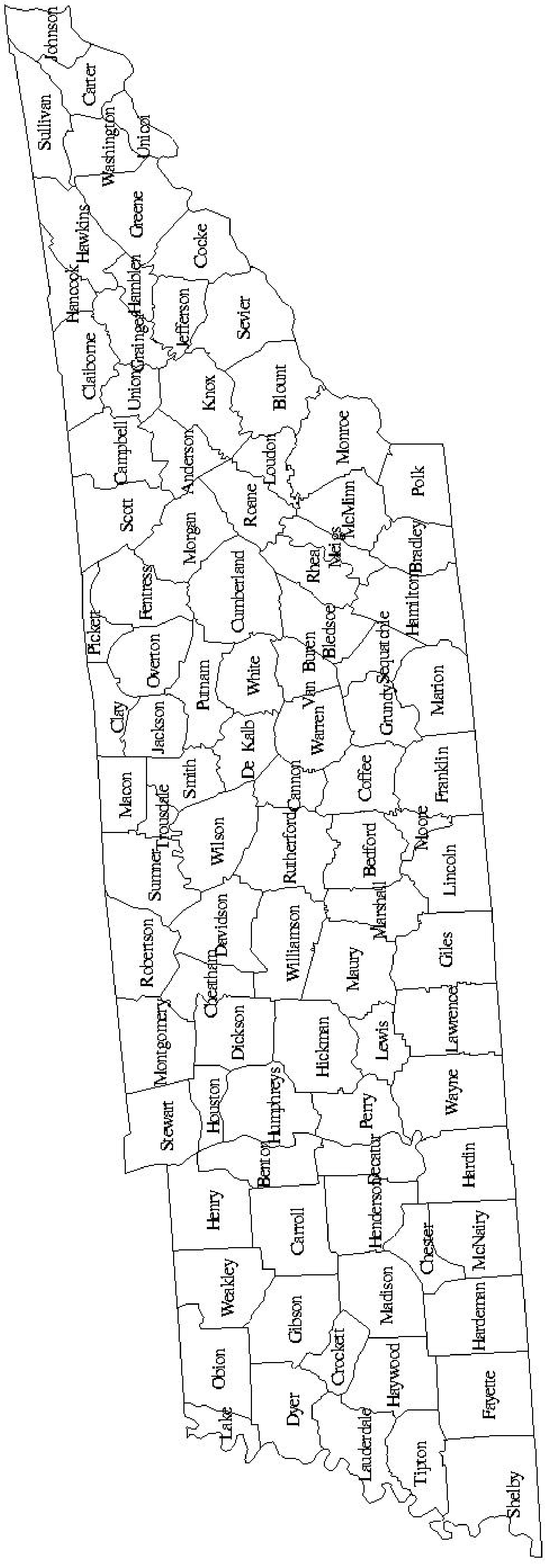
GPS Coordinate Grid



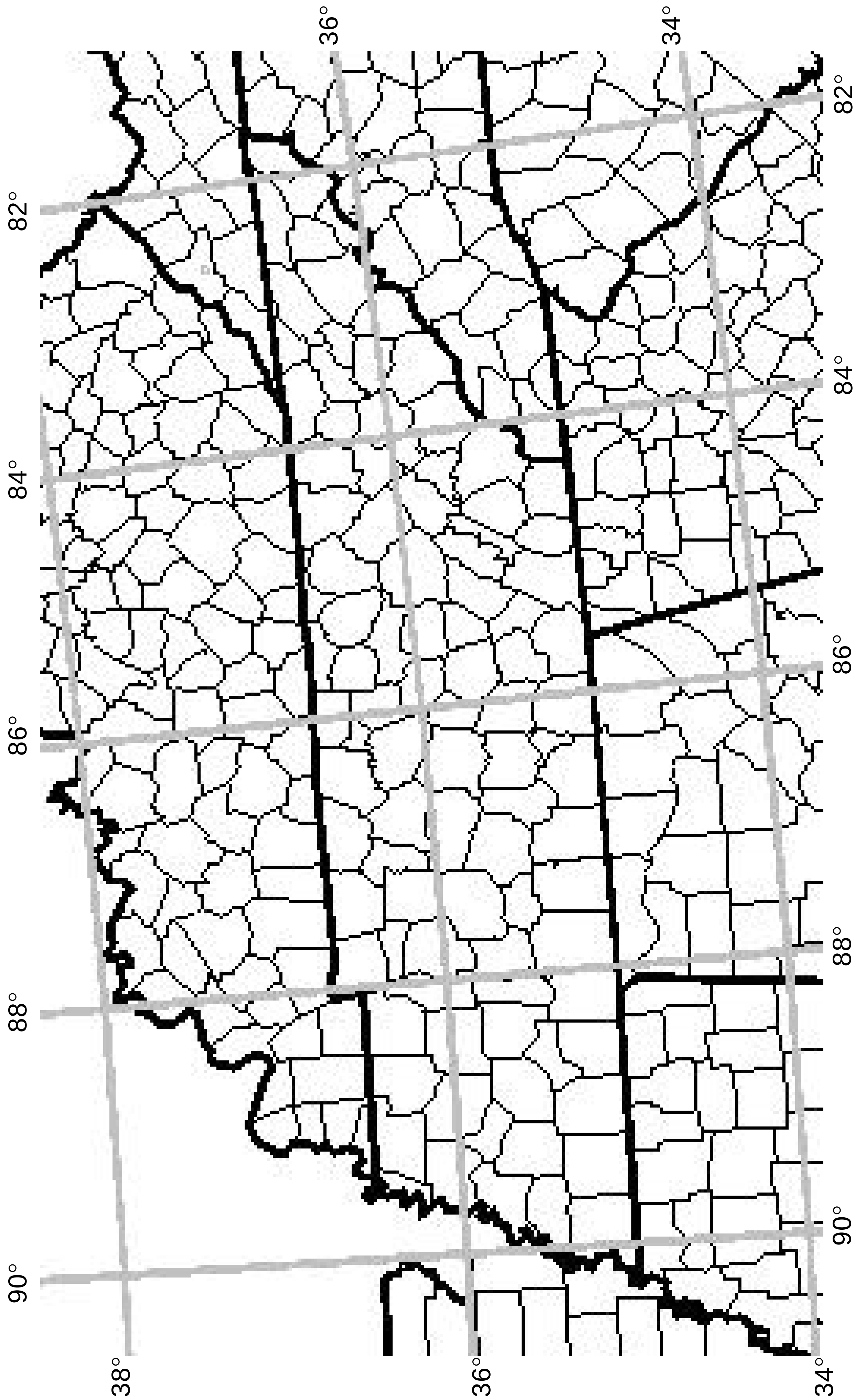
TENNESSEE - 47

Anderson	001	Lauderdale	097
Bedford	003	Lawrence	099
Benton	005	Lewis	101
Bledsoe	007	Lincoln	103
Blount	009	Loudon	105
Bradley	011	McMinn	107
Campbell	013	McNairy	109
Cannon	015	Macon	111
Carroll	017	Madison	113
Carter	019	Marion	115
Cheatham	021	Marshall	117
Chester	023	Maury	119
Claiborne	025	Meigs	121
Clay	027	Monroe	123
Cocke	029	Montgomery	125
Coffee	031	Moore	127
Crockett	033	Morgan	129
Cumberland	035	Obion	131
Davidson	037	Overton	133
Decatur	039	Perry	135
De Kalb	041	Pickett	137
Dickson	043	Polk	139
Dyer	045	Putnam	141
Fayette	047	Rhea	143
Fentress	049	Roane	145
Franklin	051	Robertson	147
Gibson	053	Rutherford	149
Giles	055	Scott	151
Grainger	057	Sequatchie	153
Greene	059	Sevier	155
Grundy	061	Shelby	157
Hamblen	063	Smith	159
Hamilton	065	Stewart	161
Hancock	067	Sullivan	163
Hardeman	069	Sumner	165
Hardin	071	Tipton	167
Hawkins	073	Trousdale	169
Haywood	075	Unicoi	171
Henderson	077	Union	173
Henry	079	Van Buren	175
Hickman	081	Warren	177
Houston	083	Washington	179
Humphreys	085	Wayne	181
Jackson	087	Weakley	183
Jefferson	089	White	185
Johnson	091	Williamson	187
Knox	093	Wilson	189
Lake	095		

Tennessee Counties



GPS Coordinate Grid



TEXAS – 48

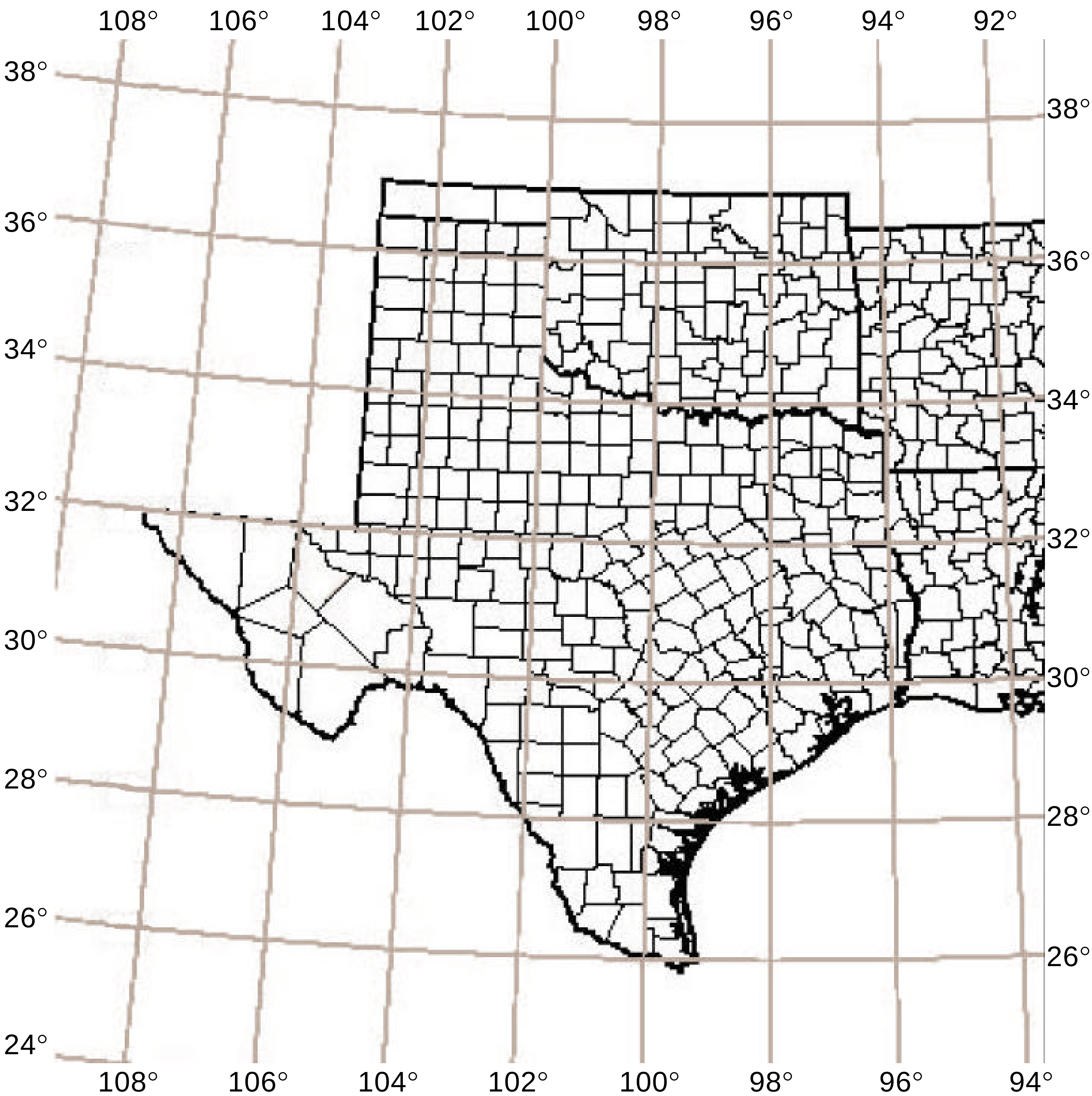
Anderson	001	Crockett	105
Andrews	003	Crosby	107
Angelina	005	Culberson	109
Aransas	007	Dallam	111
Archer	009	Dallas	113
Armstrong	011	Dawson	115
Atascosa	013	Deaf Smith	117
Austin	015	Delta	119
Bailey	017	Denton	121
Bandera	019	De Witt	123
Bastrop	021	Dickens	125
Baylor	023	Dimmit	127
Bee	025	Donley	129
Bell	027	Duval	131
Bexar	029	Eastland	133
Blanco	031	Ector	135
Borden	033	Edwards	137
Bosque	035	Ellis	139
Bowie	037	El Paso	141
Brazoria	039	Erath	143
Brazos	041	Falls	145
Brewster	043	Fannin	147
Briscoe	045	Fayette	149
Brooks	047	Fisher	151
Brown	049	Floyd	153
Burleston	051	Foard	155
Burnet	053	Fort Bend	157
Caldwell	055	Franklin	159
Calhoun	057	Freestone	161
Callahan	059	Frio	163
Cameron	061	Gaines	165
Camp	063	Galveston	167
Carson	065	Garza	169
Cass	067	Gillespie	171
Castro	069	Glasscock	173
Chambers	071	Goliad	175
Cherokee	073	Gonzales	177
Childress	075	Gray	179
Clay	077	Grayson	181
Cochran	079	Gregg	183
Coke	081	Grimes	185
Coleman	083	Guadalupe	187
Collin	085	Hale	189
Collingsworth	087	Hall	191
Colorado	089	Hamilton	193
Comal	091	Hansford	195
Comanche	093	Hardeman	197
Concho	095	Hardin	199
Cooke	097	Harris	201
Coryell	099	Harrison	203
Cottle	101	Hartley	205
Crane	103	Haskell	207

Hays	209	Martin	317
Hemphill	211	Mason	319
Henderson	213	Matagorda	321
Hidalgo	215	Maverick	323
Hill	217	Medina	325
Hockley	219	Menard	327
Hood	221	Midland	329
Hopkins	223	Milam	331
Houston	225	Mills	333
Howard	227	Mitchell	335
Hudspeth	229	Montague	337
Hunt	231	Montgomery	339
Hutchinson	233	Moore	341
Irion	235	Morris	343
Jack	237	Motley	345
Jackson	239	Nacogdoches	347
Jasper	241	Navarro	349
Jeff Davis	243	Newton	351
Jefferson	245	Nolan	353
Jim Hogg	247	Nueces	355
Jim Wells	249	Ochiltree	357
Johnson	251	Oldham	359
Jones	253	Orange	361
Karnes	255	Palo Pinto	363
Kaufman	257	Panola	365
Kendall	259	Parker	367
Kenedy	261	Parmer	369
Kent	263	Pecos	371
Kerr	265	Polk	373
Kimble	267	Potter	375
King	269	Presidio	377
Kinney	271	Rains	379
Kleberg	273	Randall	381
Knox	275	Reagan	383
Lamar	277	Real	385
Lamb	279	Red River	387
Lampasas	281	Reeves	389
La Salle	283	Refugio	391
Lavaca	285	Roberts	393
Lee	287	Robertson	395
Leon	289	Rockwall	397
Liberty	291	Runnels	399
Limestone	293	Rusk	401
Lipscomb	295	Sabine	403
Live Oak	297	San Augustine	405
Llano	299	San Jacinto	407
Loving	301	San Patricio	409
Lubbock	303	San Saba	411
Lynn	305	Schleicher	413
McCulloch	307	Scurry	415
McLennan	309	Shackelford	417
McMullen	311	Shelby	419
Madison	313	Sherman	421
Marion	315	Smith	423

Somervell	425	Van Zandt	467
Starr	427	Victoria	469
Stephens	429	Walker	471
Sterling	431	Waller	473
Stonewall	433	Ward	475
Sutton	435	Washington	477
Swisher	437	Webb	479
Tarrant	439	Wharton	481
Taylor	441	Wheeler	483
Terrell	443	Wichita	485
Terry	445	Wilbarger	487
Throckmorton	447	Willacy	489
Titus	449	Williamson	491
Tom Green	451	Wilson	493
Travis	453	Winkler	495
Trinity	455	Wise	497
Tyler	457	Wood	499
Upshur	459	Yoakum	501
Upton	461	Young	503
Uvalde	463	Zapata	505
Val Verde	465	Zavala	507

Texas Counties

GPS Coordinate Grid



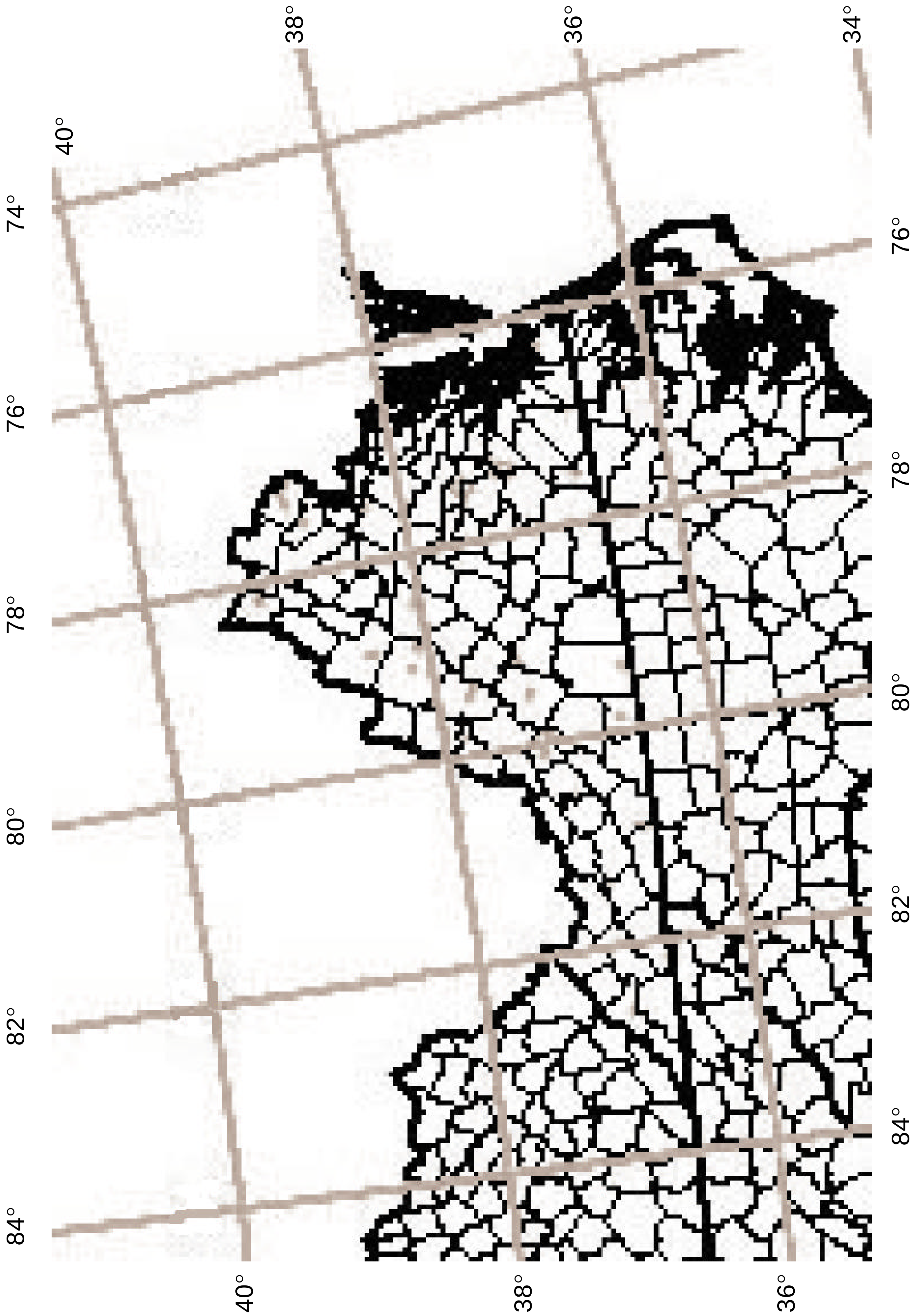
VIRGINIA – 51

Accomack	001	Loudoun	107
Albemarle	003	Louisa	109
Alleghany	005	Lunenberg	111
Amelia	007	Madison	113
Amherst	009	Mathews	115
Appomattox	011	Mecklenburg	117
Arlington	013	Middlesex	119
Augusta	015	Montgomery	121
Bath	017	Nelson	125
Bedford	019	New Kent	127
Bland	021	Northampton	131
Botetourt	023	Northumberland	133
Brunswick	025	Nottoway	135
Buchanan	027	Orange	137
Buckingham	029	Page	139
Campbell	031	Patrick	141
Caroline	033	Pittsylvania	143
Carroll	035	Powhatan	145
Charles City	036	Prince Edward	147
Charlotte	037	Prince George	149
Chesterfield	041	Prince William	153
Clarke	043	Pulaski	155
Craig	045	Rappahannock	157
Culpeper	047	Richmond	159
Cumberland	049	Roanoke	161
Dickenson	051	Rockbridge	163
Dinwiddie	053	Rockingham	165
Essex	057	Russell	167
Fairfax	059	Scott	169
Fauquier	061	Shenandoah	171
Floyd	063	Smyth	173
Fluvanna	065	Southampton	175
Franklin	067	Spotsylvania	177
Frederick	069	Stafford	179
Giles	071	Surry	181
Gloucester	073	Sussex	183
Goochland	075	Tazewell	185
Grayson	077	Warren	187
Greene	079	Washington	191
Greensville	081	Westmoreland	193
Halifax	083	Wise	195
Hanover	085	Wythe	197
Henrico	087	York	199
Henry	089	Alexandria City	510
Highland	091	Bedford City	515
Isle of Wight	093	Bristol City	520
James City	095	Buena Vista City	530
King and Queen	097	Charlottesville City	540
King George	099	Chesapeake City	550
King William	101	Clifton Gorge City	560
Lancaster	103	Colonial Heights City	570
Lee	105	Covington City	580

Danville City	590	Norfolk City	710
Emporia City	595	Norton City	720
Fairfax City	600	Petersburg City	730
Falls Church City	610	Poquoson	735
Franklin City	620	Portsmouth City	740
Fredericksburg City	630	Radford City	750
Galax City	640	Richmond City	760
Hampton City	650	Roanoke City	770
Harrisonburg City	660	Salem City	775
Hopewell City	670	South Boston City	780
Lexington City	678	Staunton City	790
Lynchburg City	680	Suffolk City	800
Manassas City	683	Virginia Beach City	810
Manassas Park	685	Waynesboro City	820
Martinsville City	690	Williamsburg City	830
Newport News City	700	Winchester City	840

Virginia Counties

GPS Coordinate Grid



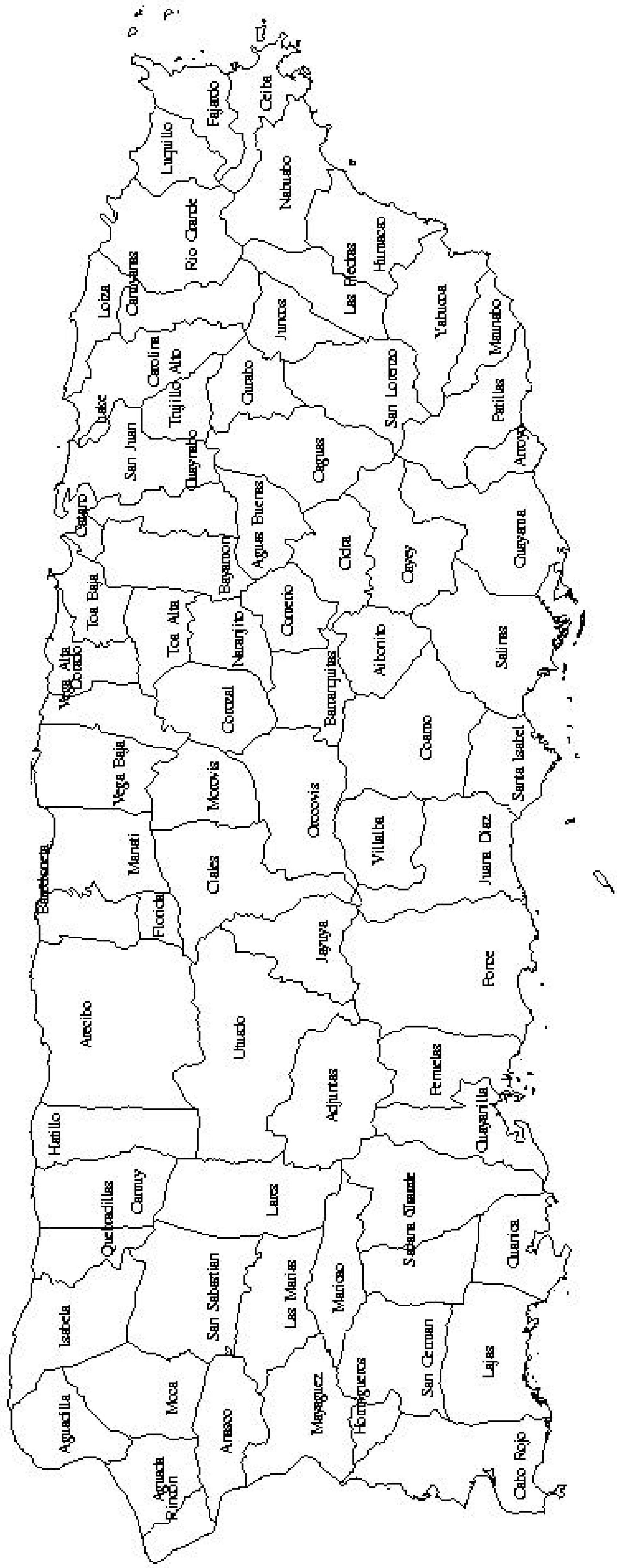
PUERTO RICO - 72

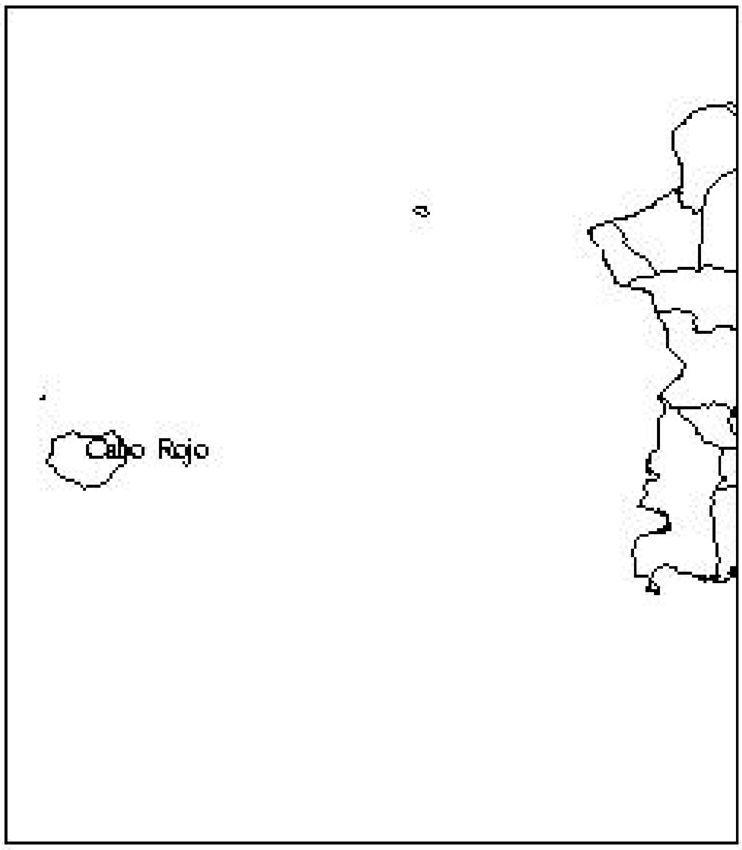
Adjuntas	001	Juncos	077
Aguada	003	Lajas	079
Aguadilla	005	Lares	081
Aguas Buenas	007	Las Marias	083
Aibonito	009	Las Piedras	085
Anasco	011	Loiza	087
Arecibo	013	Luquillo	089
Arroyo	015	Manati	091
Barceloneta	017	Maricao	093
Barranquitas	019	Maunabo	095
Bayamon	021	Mayaguez	097
Cabo Rojo	023	Moca	099
Caguas	025	Morovis	101
Camuy	027	Naguabo	103
Canovanas	029	Naranjito	105
Carolina	031	Orocovis	107
Catano	033	Patillas	109
Cayey	035	Penuelas	111
Ceiba	037	Ponce	113
Ciales	039	Quebradillas	115
Cidra	041	Rincon	117
Coamo	043	Rio Grande	119
Comerio	045	Sabana Grande	121
Corozal	047	Salinas	123
Culebra	049	San German	125
Dorado	051	San Juan	127
Fajardo	054	San Lorenzo	129
Florida	053	San Sebastian	131
Guanica	055	Santa Isabel	133
Guayama	057	Toa Alta	135
Guayanilla	059	Toa Baja	137
Guaynabo	061	Trujillo Alto	139
Gurabo	063	Utuado	141
Hatillo	065	Vega Alta	143
Hormigueros	067	Vega Baja	145
Humacao	069	Vieques	147
Isabela Municipio	071	Villalba	149
Jayuya	073	Yabucoa	151
Juana Diaz	075	Yuaco	153

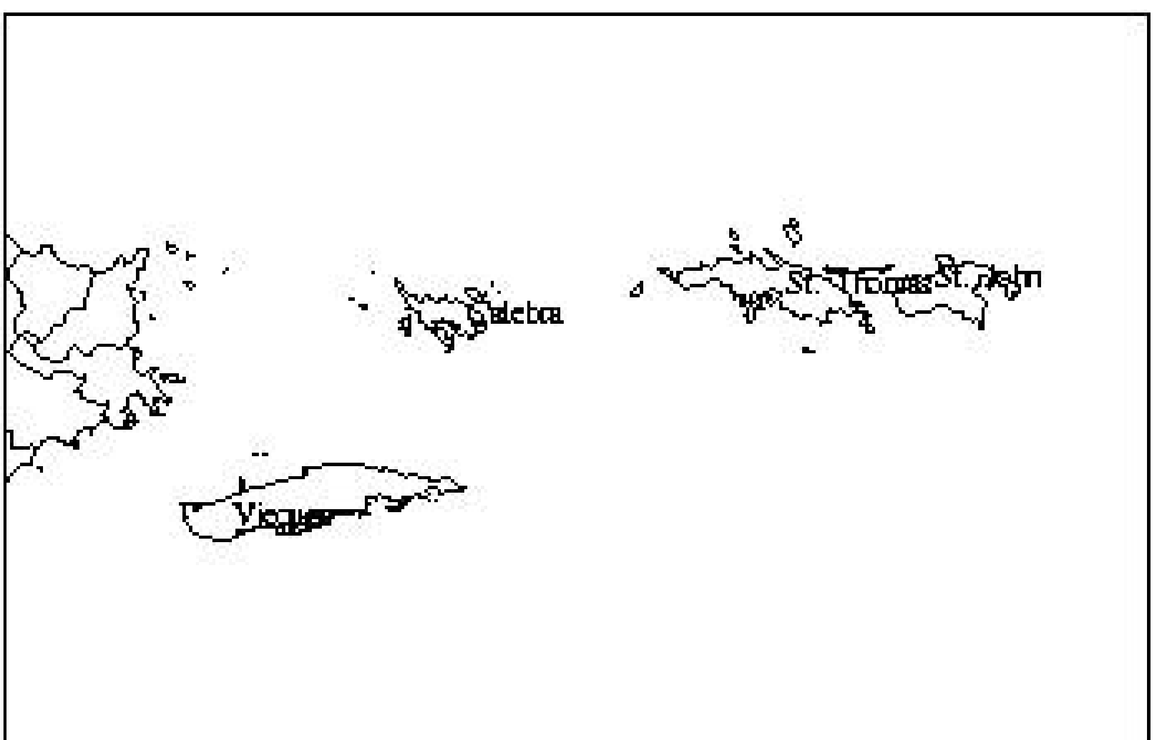
U.S. VIRGIN ISLANDS - 78

St. Croix Island	010
St. John Island	020
St. Thomas Island	030

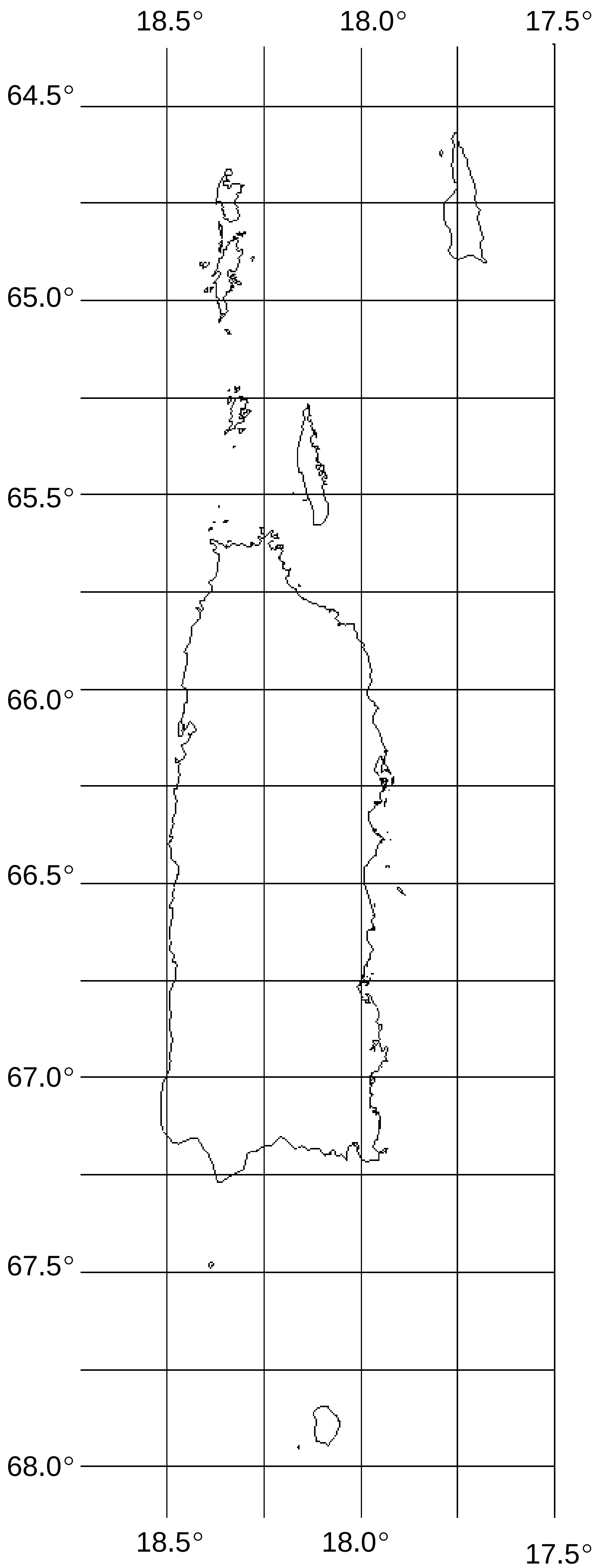
Puerto Rico Counties-U.S. Virgin Islands




Cabo Rojo


Culebra
St. Thomas
St. John
Vieques
St. Croix

GPS Coordinate Grid



APPENDIX 2

CONDITION LEVEL DATA

DETERMINATION OF STOCKING VALUES FOR LAND USE CLASSIFICATION

STOCKING REQUIREMENTS

Stocking values are required to determine if a condition is in a forested land use. This will determine which data items must be recorded for the condition. When the Condition Status is in question (usually a non-forest area that is in the process of reverting to forestland or a marginal site that can only support a low number of trees) the crew must determine if there is sufficient stocking to classify the condition as forest. A minimum stocking value of 10% is required for accessible forestland (unless the condition was previously forested and has not been placed in a nonforest land use, such as a recent clear cut).

The following tables show the number of trees per acre needed to achieve this minimum stocking value. In the determination of stocking for this purpose the field crew should consider the condition over its entire area, not just the trees and seedlings that would be tallied on the subplots and microplots, especially when the condition straddles the plot. Also, for stocking purposes consider a clump of trees (e.g., stump sprouts) less than 5 inches DBH to be a single tree.

The number of trees per acre needed to obtain minimum stocking depends on the DBH of largest tree in the condition (not necessarily a tally tree), the forest type of the condition, and the size of the trees. If the condition occurs on all 4 subplots and the trees are distributed fairly evenly over the entire condition area, the following steps can be used to determine if the condition has the minimum number of trees per acre for forestland:

> Observe the diameter of the largest tree on the condition and classify the condition into one of the following groups, 5+, 4.0-4.9, 3.0-3.9, 2.0-2.9, 1.0-1.9 and < 1.0 inch DBH classes. If a 5 inch or larger tree is present, Table b will be used, otherwise use Table a.
>
> Determine the appropriate forest type of the condition based on the tree species present in the condition and/or the forest type of similar conditions in the area.
>
> Estimate the number of trees per acre by the diameter classes shown from the appropriate table. When a condition exists on all 4 of the 24-foot radius subplots each tally tree (DBH $\geq$ 5.0 inch) represents 6 trees per acre and each sapling (DBH $\geq$ 1.0 inch to < 5.0 inch) or seedling observed on the 4 microplots represents 75 trees per acre.

In sparse stands of smaller trees, a more accurate observation of trees per acre can be determined by observing trees < 5.0 inch DBH on the 24-foot radius subplot. In many forest types no more than 180 trees per acre of the largest diameter class are needed to meet the minimum stocking requirements, a total of 30 trees on all 4 subplots, 7 or 8 smaller trees on each subplot will provide minimum stocking.

When trees of more than one diameter class are present, their contribution towards meeting the minimum must be combined. For example:

> In a lodgepole pine forest type, the largest tree in the condition is 5.0+ inch DBH. If 15 or more 5.0-6.9 inch trees were found on the four subplots the minimum of 90 trees per acre (Table b, 5th row, 6th column) would be met. In the same condition, only 3 tally trees in the 13.0-14.9 inch DBH class equal the18 trees per acre in that diameter class. If the tally were three 5.0-6.9 inch trees (18/90 = 1/5 the minimum) and two 13.0-14.9 inch DBH class trees (12/18=2/3 the minimum) the combined stocking does not meet the minimum (1/5 +2/3 < 1) and the condition would be classified non-forest.

Other things observed on the plot will influence the determination of condition status. In the last lodgepole pine example, evidence of a recent disturbance that reduced the stocking (cutting, fire, etc.) should be considered. Also, a very uneven distribution of trees across the condition can greatly change the observed number of trees per acre on plots installed across the condition.

If the condition does not cover all four subplots entirely, trees per acre must be expanded by an expansion factor. The expansion factor is equal to 400/(sum of the percent of subplot area) for the condition. The trees per acre value of every diameter class is multiplied by this expansion factor.

If the trees are not uniformly distributed throughout the condition or the condition occurs on only a small portion of the plot, (half the plot or less), use your best judgment in assigning status. You may place several additional temporary subplots in the condition in order to get a larger sample to base stocking on. When additional temporary subplots or judgment is used to assign land use, a note should be made on the plot sheet. Use the following procedure to establish these temporary subplots in a condition:

A. Consider locations 120.0 feet horizontal distance from the highest numbered subplot in the condition. First consider the location 0^o azimuth from the subplot center. If this location is unsuitable, consider in order locations at azimuth 120^o, and 240^o. When a suitable location has been found, establish the temporary subplot. Temporary subplots should be entirely within the condition (locations should not be within 24.0 feet of a mapped boundary).

B. If Step A fails to yield a suitable subplot location, repeat Step A at each of the next highest numbered regular subplot in the condition.

C. If Steps A and B have been exhausted and a suitable temporary subplot still has not been found, repeat Step A at each temporary subplot in turn beginning with the first temporary subplot that was established.

If more than one temporary subplot is to be established, repeat Steps A and B to establish the second lowest numbered temporary subplot next, and continue in order until you have enough temporary subplots established in the condition to get a good, representative estimate of stocking. The general rule for establishing temporary subplots is:

- Install the lowest temporary subplot off the highest established subplot, until all the established subplots have been exhausted.

- Then establish the lowest temporary subplot yet to be established off the lowest one already established (lowest off highest, then lowest off lowest).

If there is a transition zone between two conditions use your best judgment to be sure that trees tallied in the transition zone do not have too much weight in the assignment of a land use.

Table a. Number of trees per acre needed for minimum stocking (stocking value 10%) of forest land in conditions with no trees > 5 inch DBH.

	DBH of largest tree in the condition														
	4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		<1.0
	DBH of tally tree														
Forest type	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	<1.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0	2.0-2.9	1.0-1.9	<1.0	1.0-1.9	<1.0	<1.0
Spruce-fir	120	150	200	300	620	120	160	240	490	120	180	370	120	250	120
Black spruce	120	150	190	260	430	110	140	200	340	100	140	260	90	170	90
Shortleaf pine	120	150	210	330	840	130	170	280	670	140	220	500	150	340	170
Slash pine	110	140	200	320	870	120	170	270	700	140	220	520	150	350	170
Long leaf pine	80	100	130	200	400	80	110	160	320	80	120	240	80	160	80
Pond pine	80	100	140	220	510	90	120	180	410	90	140	310	100	210	100
E. white pine	110	140	180	280	580	110	150	220	470	110	170	350	110	230	120
Loblolly pine	100	130	180	280	670	110	150	230	530	120	180	400	120	270	130
Douglas fir	120	150	200	310	670	120	170	250	540	130	190	400	130	270	130
N. white cedar	140	180	250	400	990	150	210	330	790	170	260	600	180	400	200
Eastern hemlock	120	150	210	360	1110	130	190	310	890	150	250	660	180	440	220
Red maple	90	110	140	220	470	90	120	180	380	90	140	280	90	190	90
Maple-beech-birch	80	100	140	230	590	90	120	190	480	100	150	360	110	240	120
Paper birch	80	110	150	240	640	90	130	200	510	100	160	380	110	250	130
Oak-hickory	70	90	120	190	430	80	100	160	350	80	120	260	80	170	90
Black walnut	60	80	110	160	340	70	90	130	270	70	100	210	70	140	70
Sweet gum	130	160	220	360	950	140	190	310	760	150	240	570	170	380	190
Cherry-ash-poplar	80	100	130	180	310	80	100	140	250	70	100	190	70	120	60
Basswood	100	120	170	290	840	110	150	250	670	120	200	500	140	330	170
Elm-ash-cottonwood	80	100	140	230	600	90	120	190	480	100	150	360	110	240	120

Table b. Number of trees per acre needed for minimum stocking (stocking value 10%) of forest land in conditions with at least one tree 5 inch DBH or larger.

	DBH of tally tree																	
Forest Type	<1.0	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
Spruce-fir	740	350	230	170	140	60	40	27	20	16	13	10	9	8	7	6	5	5
Black spruce	510	310	220	170	140	70	50	35	29	24	21	18	16	15	13	12	11	10
Jack pine	630	280	180	130	110	50	30	19	14	11	9	7	6	5	4	4	3	3
Shortleaf pine	1010	390	240	180	140	60	30	22	15	11	9	7	6	5	4	3	3	3
Slash pine	1040	380	230	170	130	60	30	20	13	10	7	6	5	4	3	3	2	2
Long leaf pine	480	240	160	120	90	40	30	19	14	11	9	7	6	5	5	4	4	3
Pond pine	620	260	170	120	100	40	30	17	12	9	7	6	5	4	3	3	3	2
E. white pine	700	330	220	160	130	60	40	24	18	14	11	9	8	7	6	5	5	4
Loblolly pine	800	330	210	150	120	60	30	20	14	11	8	7	6	5	4	3	3	3
E. hemlock	1330	420	250	180	140	60	30	19	12	9	6	5	4	3	3	2	2	2
Red maple	560	260	170	130	100	50	30	19	14	11	9	7	6	5	4	4	4	3
Map.-beech-bir.	710	270	170	120	90	40	20	15	10	7	6	4	4	3	3	2	2	2
Paper birch	760	280	170	130	100	50	20	15	10	7	6	4	4	3	3	2	2	2
Oak-hickory	520	230	150	110	80	40	20	15	11	8	7	5	4	4	3	3	2	2
Black walnut	410	190	130	90	80	30	20	14	11	8	7	6	5	4	4	3	3	2
Sweet gum	1150	430	260	190	150	70	40	23	16	12	9	7	6	5	4	3	3	3
Cher.-ash-poplar	370	220	150	120	100	40	30	23	18	15	13	11	10	9	8	7	7	6
Basswood	1000	340	200	150	110	50	30	16	11	8	6	4	4	3	2	2	2	2
Elm-ash-ctwd.	720	270	170	120	90	40	20	15	10	7	6	4	4	3	3	2	2	2

EASTERN FOREST TYPE DESCRIPTIONS

WHITE/RED/JACK PINE GROUP

103 Eastern white pine: Associates – pitch pine, gray birch, aspen, red maple, pin cherry, white oak, paper birch, sweet birch, yellow birch, black cherry, white ash, northern red oak, sugar maple, basswood, hemlock, northern white-cedar, yellow-poplar, white oak, chestnut oak, scarlet oak, and shortleaf pine. Sites--wide variety, but best development on well drained sands and sandy loams.

104 Eastern white pine/ Eastern hemlock: Associates – beech, sugar maple, basswood, red maple, yellow birch, black cherry, white ash, paper birch, sweet birch, northern red oak, white oak, chestnut oak, yellow-poplar, and cucumbertree. Sites--wide variety but favors cool locations, moist ravines, and north slopes.

105 Eastern hemlock: Associates – beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, white pine, paper birch, sweet birch, northern red oak, and white oak. Sites--cool locations, moist ravines, and north slopes.

SPRUCE/FIR GROUP

121 Balsam fir: Associates – black, white, or red spruce; paper or yellow birch; quaking or bigtooth aspen, beech; red maple; hemlock; tamarack; black ash; or northern white-cedar. Sites--upland sites on low lying moist flats and in swamps.

123 Red Spruce: Associates – vary widely and may include red maple, yellow birch, eastern hemlock, eastern white pine, white spruce, northern white-cedar, paper birch, pin cherry, gray birch, mountain ash, beech, striped maple, sugar maple, northern red oak, red pine, and aspen. Sites--include moderately well drained to poorly drained flats and thin-slopes and on varying acidic soils in abandoned fields and pastures. This code should be used where red spruce comprises a plurality or majority of the stand's stocking but where balsam fir is either nonexistent or has very little stocking. Otherwise the plot would be coded 124, red spruce/balsam fir.

124 Red spruce/balsam fir: Associates – red maple, paper birch, white pine, hemlock, white spruce, and northern white-cedar. Sites--moderately drained to poorly drained flats or on thin-soiled upper slopes.

LONGLEAF/SLASH PINE GROUP

141 Longleaf pine: Longleaf pine occurs as a pure type or comprises a majority of the trees in the overstory. Associates-slash, loblolly and shortleaf pine, southern red oak, blackjack oak, water oak, persimmon, and sweetgum. Sites--those areas that can and do burn on a periodic basis--usually occurs on middle and upper slopes with a low severity of hardwood and brush competition. Regional distribution--coastal plain and piedmont units.

142 Slash pine: Slash pine is pure or provides a majority of the stocking. Associates--on moist sites; a wide variety of moist-site hardwoods, pond pine, and pondcypress. On dry sites; a wide variety of dry-site hardwoods, longleaf, loblolly, and sand pine. Sites--both moist and well-drained flatwoods, and bays. Regional distribution--coastal plain and piedmont units from North Carolina to Florida.

LOBLOLLY/SHORTLEAF PINE GROUP

161 Loblolly pine: Associates – sweetgum, southern red oak, post oak, blackjack oak, blackgum, yellow-poplar, and pond pine. Sites--upland soils with abundant moisture but good drainage and on poorly drained depressions.

162 Shortleaf pine: Associates – white oak, southern red oak, scarlet oak, black oak, hickory, post oak, blackjack oak, blackgum, red maple, pitch pine, and Virginia pine. Sites--low, well drained ridges to rocky, dry, south slopes and the better drained spur ridges on north slopes and also on old fields.

163 Virginia pine: Associates – shortleaf pine, white oak, chestnut oak, southern red oak, black oak, sweetgum, red maple, blackgum, and pitch pine. Sites--dry sites, often abandoned fields.

164 Sand pine: Sand pine occurs in pure stands or provides a majority of the stocking. Associates--dwarf live oak, dwarf post oak, turkey oak, persimmon, and longleaf pine. Sites--dry, acidic, infertile sands. Regional distribution--found chiefly in the central peninsula and panhandle of Florida, although planted stands extend into the sandhills of Georgia and South Carolina.

165 Table-mountain pine: Associates – chestnut oak, scarlet oak, pitch pine, pine, and black oak. Sites--poor, dry, often rocky slopes.

166 Pond pine: Associates – loblolly pine, sweetgum, baldcypress, and Atlantic white-cedar. Sites--rare, but found in southern New Jersey, Delaware, and Maryland in low, poorly drained acres, swamps, and marshes.

167 Pitch pine: Associates – chestnut oak, scarlet oak, table-mountain pine, black oak, and blackgum. Sites--relatively infertile ridges, dry flats, and slopes.

168 Spruce pine: Spruce pine comprises a majority of the stocking. Associates--any of the moist site softwood or hardwood species. Sites--moist or poorly drained areas. Regional distribution--this type is rarely encountered and is found almost exclusively in the coastal plain.

PINYON / JUNIPER GROUP

181 Eastern redcedar: Associates – gray birch, red maple, sweetbirch, Virginia Pine, shortleaf pine, oak. Sites--usually dry uplands and abandoned fields on limestone outcrops and other shallow soils but can grow well on good sites.

182 Rocky Mountain juniper

184 Juniper woodland

185 Pinyon juniper woodland

PONDEROSA PINE GROUP

221 Ponderosa pine

OTHER WESTERN SOFWOODS GROUP

366 Limber pine

368 Miscellaneous western softwoods

EXOTIC SOFTWOODS GROUP

381 Scotch pine: plantation type, not naturally occurring.

382 Australian pine:

383 Other exotic softwoods

384 Norway spruce: plantation type, not naturally occurring

OAK/PINE GROUP

401 Eastern white pine/northern red oak/white ash: Associates – red maple, basswood, yellow birch, bigtooth aspen, sugar maple, beech, paper birch, black cherry, hemlock, and sweet birch. Sites--deep, fertile, well-drained soil.

402 Eastern redcedar/hardwood: Associates – oak, hickory, walnut, ash, locust, dogwood, blackgum, hackberry, winged elm, shortleaf pine, and Virginia pine. Sites--usually dry uplands and abandoned fields.

403 Longleaf pine/oak: Longleaf pine and scrub oaks-primarily turkey, bluejack, blackjack, and dwarf post oak--comprise the type. Associates--southern scrub oaks in the understory. Sites--common on sandhills where soils are dry, infertile, and coarse textured. Regional distribution-- coastal plain and piedmont units.

404 Shortleaf pine/oak: Associates - (oaks generally include white, scarlet, blackjack, black, post, and southern red) hickory, blackgum, sweetgum, Virginia pine, and pitch pine. Sites--generally in dry, low ridges, flats, and south slopes.

405 Virginia pine/southern red oak: Associates – black oak, scarlet oak, white oak, post oak, blackjack oak, shortleaf pine, blackgum, hickory, pitch pine, table-mountain pine, chestnut oak. Sites--dry slopes and ridges.

406 Loblolly pine/hardwood: Associates – wide variety of moist and wet site hardwoods including blackgum, sweetgum, yellow-poplar, red maple, white and green ash, and American elm; on drier sites associates include southern and northern red oak, white oak, post oak, scarlet oak, persimmon, and hickory. Sites--usually moist to very moist though not wet all year but also on drier sites.

407 Slash pine/hardwood: Slash pine and a variable mixture of hardwoods comprise the type. Associates-- codominant with the slash pine component are sweetbay, blackgum, loblolly-bay, pondcypress, pond pine, Atlantic white-cedar, red maple, ash, and water oak. Sites--undrained or poorly drained depressions such as bays or pocosins and along pond margins. Regional distribution--primarily coastal plain units.

409 Other pine/hardwood:

OAK/HICKORY GROUP

501 Post oak/blackjack oak: Associates – blackjack oak, hickory, southern red oak, white oak, scarlet oak, shingle oak, live oak, shortleaf pine, Virginia pine, blackgum, sourwood, red maple, winged elm, hackberry, chinkapin oak, shumard oak, dogwood, and eastern redcedar. Sites--dry uplands and ridges.

502 Chestnut oak: Associates – scarlet oak, white oak, black oak, post oak, pitch pine, blackgum, sweetgum, red maple, red oak, shortleaf pine, Virginia pine. Sites--rocky outcrops with thin soil, ridge tops.

503 White oak/red oak/hickory: Associates – scarlet oak, bur oak, pinoak, white ash, sugar maple, red maple, walnut, basswood, locust, beech, sweetgum, blackgum, yellow-poplar, and dogwood. Sites--wide variety of well drained upland soils.

504 White oak: Associates – black oak, northern red oak, bur oak, hickory, white ash, yellow-poplar. Sites--scattered patches on upland, loamy soils but on drier sites than type 503.

505 Northern red oak: Associates – black oak, scarlet oak, chestnut oak, and yellow-poplar. Sites--spotty distribution on ridge crests and north slopes in mountains but also found on rolling land, slopes, and benches on loamy soil.

506 Yellow-poplar/white oak/northern red oak: Associates – blackoak, hemlock, blackgum, and hickory. Sites--northern slopes, coves, and moist flats.

507 Sassafras/persimmon: Associates – elm, eastern redcedar, hickory, ash, sugar maple, yellow-poplar, and oaks. Sites--abandoned farmlands and old fields.

508 Sweetgum/yellow-poplar: Associates – red maple, white ash, green ash, and other moist site hardwoods. Sites--generally occupies moist, lower slopes.

509 Bur oak: Associates—northern pin oak, black oak, chinkapin oak, and eastern redcedar in northern and dry upland sites; shagbark hickory, black walnut, eastern cottonwood, white ash, American elm, swamp white oak, honey locust, and American basswood in southern and lowland sites. Sites – drier uplands to moist bottomlands with the drier uplands more common in the northern part of the range and the moist bottomlands more common in the southern part of the range.

510 Scarlet oak: Associates – black oak, southern red oak, chestnut oak, white oak, post oak, hickory, pitch pine, blackgum, sweetgum, black locust, sourwood, dogwood, shortleaf pine, and Virginia pine. Sites--dry ridges, south- or west-facing slopes and flats but often moister situations probably as a result of logging or fire.

511 Yellow-poplar: Associates – black locust, red maple, sweet birch, cucumbertree, and other moist-site hardwoods (except sweetgum, see type 508) and white oak and northern red oak (see type 503). Sites--lower slopes, northerly slopes, moist coves, flats, and old fields.

512 Black Walnut: Associates – yellow-poplar, white ash, black cherry, basswood, beech, sugar maple, oaks, and hickory. Sites--coves and well-drained bottoms.

513 Black locust: Associates – many species of hardwoods and hardpines may occur with it in mixture, either having been planted or from natural seeding. Sites--may occur on any well-drained soil but best on dry sites, often in old fields.

514 Southern scrub oak: This forest cover type consists of a mixture of scrub oaks that may include several of the following species: turkey oak, bluejack oak, blackjack oak, dwarf post oak, and dwarf live oak. Sites--dry sandy ridges-the type frequently develops on areas formerly occupied by longleaf pine. Regional distribution--common throughout all coastal plain units and into the lower piedmont.

515 Chestnut oak / black oak / scarlet oak: Associates—northern and southern red oaks, post oak, white oak, sourwood, shagbark hickory, pignut hickory, yellow-poplar, blackgum, sweetgum, red maple, eastern white pine, pitch pine, Table Mountain pine, shortleaf pine, and Virginia pine. Sites—dry upland sites on thin-soiled rocky outcrops on dry ridges and slopes.

519 Red maple / oak: Associates – the type is dominated by red maple and some of the wide variety of central hardwood associates include upland oak, hickory, yellow-poplar, black locust, sassafras as well as some central softwoods like Virginia and shortleaf pines. Sites -- uplands.

520 Mixed upland hardwoods: Associates – Any mixture of hardwoods of species typical of the upland central hardwood region, should include at least some oak. Sites--wide variety of upland sites.

OAK/GUM/CYPRESS GROUP

601 Swamp chestnut oak/cherrybark oak: Associates – white ash, hickory, white oak, shumard oak, blackgum, sweetgum, southern red oak, post oak, American elm, winged elm, yellow-poplar, and beech. Sites--within alluvial flood plains of major rivers on all ridges in the terraces and on the best fine sandy loam soils on the highest first bottom ridges.

602 Sweetgum/Nuttall oak/willow oak: Associates – green ash, American elm, pecan, cottonwood, red maple, honeylocust, and persimmon. Sites--very wet.

605 Overcup oak/water hickory: Associates – willow oak, American elm, green ash, hackberry, persimmon, and red maple. Sites--in South within alluvial flood plains in low, poorly drained flats with clay soils; also in sloughs and lowest backwater basins and low ridges with heavy soils that are subject to late spring inundation.

606 Atlantic white-cedar: Associates – North includes gray birch, pitch pine, hemlock, blackgum, and red maple. South includes pond pine, baldcypress, and red maple. Sites--usually confined to sandy-bottomed, peaty, interior, and river swamps, wet depressions, and stream banks.

607 Baldcypress/water tupelo: Associates – willow, red maple, American elm, persimmon, overcup oak, and sweetgum. Sites--very low, poorly drained flats, deep sloughs, and swamps wet most all the year.

608 Sweetbay/swamp tupelo/red maple: Associates – blackgum, loblolly and pond pines, American elm, and other moist-site hardwoods. Sites--very moist but seldom wet all year--shallow ponds, muck swamps, along smaller creeks in Coastal Plain (rare in Northeast).

ELM/ASH/COTTONWOOD GROUP

701 Black ash/American elm/red maple: Associates – silver maple, swampwhite oak, sycamore, pin oak, blackgum, white ash, and cottonwood. Sites--moist to wet areas, swamps, gullies, and poorly drained flats.

702 River birch/sycamore: Associates – red maple, black willow, and other moist-site hardwoods. Sites--moist soils at edges of creeks and rivers.

703 Cottonwood: Associates – willow, white ash, green ash, and sycamore. Sites--streambanks where bare, moist soil is available.

704 Willow: Associates – cottonwood, green ash, sycamore, pecan, American elm, red maple, and boxelder. Sites--streambanks where bare, moist soil is available.

705 Sycamore/pecan/American elm: Associates – boxelder, green ash, hackberry, silver maple, cottonwood, willow, sweetgum, and river birch. Sites--bottomlands, alluvial flood plains of major rivers.

706 Sugarberry/hackberry/elm/green ash: Associates – pecan, blackgum, persimmon, honeylocust, red maple, hackberry, and boxelder. Sites--low ridges and flats in flood plains.

707 Silver maple/American elm

708 Red maple/lowland

709 Cottonwood/willow: Associates – white ash, green ash sycamore, American elm, red maple and boxelder. Sites – stream banks where bare, moist soil is available.

MAPLE/BEECH/BIRCH GROUP

801 Sugar maple/beech/yellow birch: Associates – basswood, red maple, hemlock, northern red oak, white ash, white pine, black cherry, sweet birch, American elm, rock elm, and eastern hophornbeam. Sites--fertile, moist, well-drained sites.

802 Black cherry: Associates – sugar maple, northern red oak, red maple, white ash, basswood, sweet birch, butternut, American elm, and hemlock. Sites--fertile, moist, well-drained sites.

803 Cherry/ash/yellow-poplar: Associates – sugar maple, American beech, northern red oak, white oak, blackgum, hickory, cucumbertree, and yellow birch. Sites -- fertile, moist, well-drained sites.

805 Hard maple/basswood: Associates – white ash, northern red oak, eastern hophornbeam, American elm, red maple, eastern white pine, eastern hemlock. Sugar maple and basswood occur in different proportions but together comprise the majority of the stocking. Sites -- fertile, moist, well-drained sites.

807 Elm/ash/locust: Associates – Locust, silver maple, boxelder, elm, red maple, green ash predominate. Found in North Central region, unknown in Northeast. Sites--upland

809 Red maple/upland: Associates – the type is dominated by red maple and some of the wide variety of northern hardwood associates include sugar maple, beech, birch, aspen, as well as some northern softwoods like white pine, red pine, and hemlock; this type is often man-made and may be the result of repeated cuttings. Sites -- uplands. (See Type 519 under oak/hickory group)

WESTERN OAK GROUP

925 Deciduous oak woodland

OTHER WESTERN HARDWOODS GROUP

952 Mesquite woodland

955 Miscellaneous western hardwood woodlands

TROPICAL HARDWOODS GROUP

981 Sabal palm:

982 Mangrove: Forests in which mangrove comprises a majority of the stocking. Associates--cabbage palm on some of the higher sites in the area. Sites--predominantly salt marshes; mangrove frequently develops its own island or shoreline made up of a dense mat of root structures. Regional distribution--restricted to South Florida and the Keys.

989 Other tropical:

EXOTIC HARDWOODS GROUP

991 Paulownia:

992 Melaleuca:

993 Eucalyptus:

995 Other exotic hardwoods:

NON STOCKED

999 The site qualifies as forest but is presently stocked with too few trees to assign a forest type.

APPENDIX 3

TREE LEVEL DATA

SOUTHERN U.S. TREE SPECIES CODES

The following list includes tree species tallied in the southern FIA region. (w) designates woodland species where DRC is measured instead of DBH. All codes that are not shaded are on the FIA national species list. Shaded codes 100, 690, 912, and 998 are southern regional codes – followed by (regional). The other shaded codes are tropical tree species that are collected in Florida only – followed by (FL).

Code	Common Name	Genus	Specific epithet
010	fir spp.	Abies	spp.
012	balsam fir	Abies	balsamea
016	Fraser fir	Abies	fraseri
043	Atlantic white-cedar	Chamaecyparis	thyoides
051	Arizona cypress	Cupressus	arizonica
057	redcedar / juniper	Juniperus	spp.
059	redberry juniper (w)	Juniperus	erythrocarpa
061	Ashe juniper	Juniperus	ashei
063	alligator juniper (w)	Juniperus	deppeana
066	Rocky Mnt. juniper (w)	Juniperus	scopulorum
067	southern redcedar	Juniperus	silicicola
068	eastern redcedar	Juniperus	virginiana
069	oneseed juniper (w)	Juniperus	monosperma
090	spruce spp.	Picea	spp.
091	Norway spruce	Picea	abies
094	white spruce	Picea	glauca
095	black spruce	Picea	mariana
096	blue spruce	Picea	pungens
097	red spruce	Picea	rubens
100	pine spp. (regional)	Pinus	spp.
106	common pinyon (w)	Pinus	edulis
107	sand pine	Pinus	clausa
110	shortleaf pine	Pinus	echinata
111	slash pine	Pinus	elliottii
113	limber pine	Pinus	flexilis
115	spruce pine	Pinus	glabra
121	longleaf pine	Pinus	palustris
122	ponderosa pine	Pinus	ponderosa
123	Table Mountain pine	Pinus	pungens
125	red pine	Pinus	resinosa
126	pitch pine	Pinus	rigida
128	pond pine	Pinus	serotina
129	eastern white pine	Pinus	strobus
130	Scotch pine	Pinus	sylvestris
131	loblolly pine	Pinus	taeda
132	Virginia pine	Pinus	virginiana
136	Austrian pine	Pinus	nigra
140	Mexican pinyon pine	Pinus	cemroides
150	Caribbean pine (FL)	Pinus	caribaea
221	baldcypress	Taxodium	distichum
222	pondcypress	Taxodium	distichum var.nutans
234	Florida yew (FL)	Taxus	floridana
241	northern white-cedar	Thuja	occidentalis
252	Florida torreya	Torreya	taxifolia

Code	Common Name	Genus	Specific epithet
260	hemlock spp.	Tsuga	spp.
261	eastern hemlock	Tsuga	canadensis
262	Carolina hemlock	Tsuga	caroliniana
270	Australian pine	Causarina	spp.
299	unknown dead conifer	UNKNOWN	UNKNOWN
310	maple spp.	Acer	spp.
311	Florida maple	Acer	barbatum
313	boxelder	Acer	negundo
314	black maple	Acer	nigrum
315	striped maple	Acer	pensylvanicum
316	red maple	Acer	rubrum
317	silver maple	Acer	saccharinum
318	sugar maple	Acer	saccharum
319	mountain maple	Acer	spicatum
320	Norway maple	Acer	platinoides
323	chalk maple	Acer	leucoderme
330	buckeye, horsechestnut spp.	Aesculus	spp.
331	Ohio buckeye	Aesculus	glabra
332	yellow buckeye	Aesculus	octandra
334	Texas buckeye	Aesculus	glabra var. arguta
341	ailanthus	Ailanthus	altissima
345	mimosa, silktree	Albizzia	julibrisson
351	red alder	Alnus	rubra
355	European Alder	Alnus	glutinosa
356	serviceberry spp.	Amelanchier	spp.
367	pawpaw	Asimina	triloba
370	birch spp.	Betula	spp.
371	yellow birch	Betula	alleghaniensis
372	sweet birch	Betula	lenta
373	river birch	Betula	nigra
374	water birch	Betula	occidentalis
379	gray birch	Betula	populifolla
381	chittamwood,gum bumelia	Bumelia	lanuginosa
391	American hornbeam, musclewood	Carpinus	caroliniana
400	hickory spp.	Carya	spp.
401	water hickory	Carya	aquatica
402	bitternut hickory	Carya	cordiformis
403	pignut hickory	Carya	glabra
404	pecan	Carya	illinoensis
405	shellbark hickory	Carya	laciniosa
406	nutmeg hickory	Carya	myristiciformis
407	shagbark hickory	Carya	ovata
408	black hickory	Carya	texana
409	mockernut hickory	Carya	tomentosa
410	sand hickory	Carya	pallida
421	American chestnut	Castanea	dentata
422	Allegheny chinkapin	Castanea	pumila
423	Ozark chinkapin	Castanea	ozarkensis
450	catalpa spp.	Catalpa	spp.
451	southern catalpa	Catalpa	bignonioides
452	northern catalpa	Catalpa	speciosa

Code	Common Name	Genus	Specific epithet
460	hackberry spp.	Celtis	spp.
461	sugarberry	Celtis	laevigata
462	hackberry	Celtis	occidentalis
463	netleaf hackberry	Celtis	reticulata
471	eastern redbud	Cercis	canadensis
481	yellowwood	Cladrastis	kentukea
491	flowering dogwood	Cornus	florida
500	hawthorn	Crataegus	spp.
501	cockspur hawthorn	Crataegus	crus-galli
502	downy hawthorn	Crataegus	mollis
510	eucalyptus	Eucalyptus	spp.
521	common persimmon	Diospyros	virginiana
531	American beech	Fagus	grandifolia
540	ash spp.	Fraxinus	spp.
541	white ash	Fraxinus	americana
543	black ash	Fraxinus	nigra
544	green ash	Fraxinus	pennsylvanica
545	pumpkin ash	Fraxinus	profunda
546	blue ash	Fraxinus	quadrangulata
547	velvet ash	Fraxinus	velutina
548	Carolina ash	Fraxinus	caroliniana
551	waterlocust	Gleditsia	aquatica
552	honeylocust	Gleditsia	triacanthos
555	loblolly-bay	Gordonia	lasianthus
571	Kentucky coffeetree	Gymnocladus	dioicus
580	silverbell	Halesia	spp.
591	American holly	Ilex	opaca
600	walnut spp.	Juglans	spp.
601	butternut	Juglans	cinerea
602	black walnut	Juglans	nigra
605	Texas walnut	Juglans	microcarpa
611	sweetgum	Liquidambar	styraciflua
621	yellow-poplar	Liriodendron	tuliperfia
641	Osage-orange	Maclura	pomifera
650	magnolia spp.	Magnolia	spp.
651	cucumbertree	Magnolia	acuminata
652	southern magnolia	Magnolia	grandiflora
653	sweetbay	Magnolia	virginiana
654	bigleaf magnolia	Magnolia	macrophylla
655	mountain magnolia	Magnolia	fraseri
660	apple spp.	Malus	spp.
680	mulberry spp.	Morus	spp.
681	white mulberry	Morus	alba
682	red mulberry	Morus	rubra
690	gum, tupelo (regional)	Nyssa	spp.
691	water tupelo	Nyssa	aquatica
692	Ogeechee tupelo	Nyssa	ogeche
693	blackgum	Nyssa	sylvatica
694	swamp tupelo	Nyssa	sylvatica var. biflora
701	eastern hophornbeam	Ostrya	virginiana
711	sourwood	Oxydendrum	arboreum
712	paulownia, empress-tree	Poulownia	tomentosa
721	redbay	Persea	borbonia

Code	Common Name	Genus	Specific epithet
722	water-elm, planertree	Planera	aquatica
731	sycamore	Platanus	occidentallis
740	cottonwood, poplar spp.	Populus	spp.
741	balsam poplar	Populus	balsamifera
742	eastern cottonwood	Populus	deltoides
743	bigtooth aspen	Populus	grandidentata
744	swamp cottonwood	Populus	heterophylla
746	quaking aspen	Populus	tremuloides
748	Rio Grande cottonwood, Fremont poplar	Populus	deltoides ssp. wislizeni
749	narrowleaf poplar	Populus	angustifolia
752	silver poplar	Populus	alba
755	mesquite spp.	Prosopis	spp.
756	western honey mesquite	Prosopis	glandulosa var. torreyana
757	velvet mesquite	Prosopis	velutina
758	screwbean mesquite	Prosopis	pubescens
760	cherry and plum spp.	Prunus	spp.
761	pin cherry (fire cherry)	Prunus	pensylvanica
762	black cherry	Prunus	serotina
763	chokecherry	Prunus	virginiana
766	wild plum	Prunus	americana
800	oak -- deciduous	Quercus	spp.
802	white oak	Quercus	alba
803	Arizona white oak (w)	Quercus	arizonica
	and gray oak (w)	Quercus	grisea
804	swamp white oak	Quercus	bicolor
806	scarlet oak	Quercus	coccinea
808	Durand oak	Quercus	durandii
809	northern pin oak	Quercus	ellipsoidalis
810	Emery oak (w)	Quercus	emoryi
812	southern red oak	Quercus	falcata var.falcata
813	cherrybark oak	Quercus	falcata var.pagodifolia
814	Gambel oak (w)	Quercus	gambelii
816	bear oak, scrub oak	Quercus	ilicifolia
817	shingle oak	Quercus	imbricaria
819	turkey oak	Quercus	laevis
820	laurel oak	Quercus	laurifolia
822	overcup oak	Quercus	lyrata
823	bur oak	Quercus	macrocarpa
824	blackjack oak	Quercus	marilandica
825	swamp chestnut oak	Quercus	michauxii
826	chinkapin oak	Quercus	muehlenbergii
827	water oak	Quercus	nigra
828	Nuttall oak	Quercus	nuttallii
830	pin oak	Quercus	palustris
831	willow oak	Quercus	phellos
832	chestnut oak	Quercus	prinus
833	northern red oak	Quercus	rubra
834	Shumard oak	Quercus	shumardii
835	post oak	Quercus	stellata
836	Delta post oak	Quercus	stellata var. mississippiensis
837	black oak	Quercus	velutina
838	live oak	Quercus	virginiana

Code	Common Name	Genus	Specific epithet
840	dwarf post oak	Quercus	stellata var. margaretta
841	dwarf live oak	Quercus	minima
842	bluejack oak	Quercus	incana
843	silverleaf oak (w)	Quercus	hypoleucoldes
844	Oglethorpe oak	Quercus	oglethorpensis
845	Dwarf chinkapin oak	Quercus	prinoides
850	oak – evergreen (w)	Quercus	spp.
852	torchwood (FL)	Amyris	elemifera
853	pond apple (FL)	Annona	glabra
854	gumbo limbo (FL)	Bursera	simaruba
855	camphor tree (FL)	Cinnamomum	camphora
856	fiddlewood (FL)	Citharexylum	fruticosum
857	citrus spp. (FL)	Citrus	spp.
863	pigeon plum (tietongue)(FL)	Coccoloba	diversifolia
864	soldierwood (FL)	Colubrina	elliptica
865	geiger tree (FL)	Cordia	sebestena
866	carrotwood (FL)	Cupaniopsis	anacardioides
873	red stopper (FL)	Eugenia	rhombea
874	inkwood (butterbough) (FL)	Exothea	paniculata
876	strangler fig (FL)	Ficus	aurea
877	shortleaf fig (wild banyantree) (FL)	Ficus	citrofolia
882	blolly (beeftree) (FL)	Guapira	discolor
883	manchineel (FL)	Hippomane	mancinella
884	false tamarind (FL)	Lysiloma	latisiliquum
885	mango (FL)	Mangifera	indica
886	poisonwood (FL)	Metopium	toxiferum
887	fishpoison tree (FL)	Piscidia	piscipula
888	schefflera (octopus tree) (FL)	Schefflera	actinophylla
890	false mastic (FL)	Sideroxylon	foetidissimum
891	white bully (willow bustic) (FL)	Sideroxylon	salicifolium
895	paradise tree (FL)	Simarouba	glauca
896	java plum (FL)	Syzygium	cumini
897	tamarind (FL)	Tamarindus	indica
898	other tropical (FL)		
901	black locust	Robinia	pseudoacacia
902	New Mexico locust	Robinia	neomexicana
906	paurotis palm (FL)	Acoelorrhaphe	wrightii
907	silver palm (FL)	Coccothrinax	argentata
908	coconut palm (FL)	Cocos	nucifera
909	royal palm (FL)	Roystonea	spp.
911	other sabal spp.	Sabal	spp.
912	sabal palmetto (regional)	Sabal	palmetto
913	key thatch palm (FL)	Thrinax	morrisii
914	Florida thatch palm (FL)	Thrinax	radiata
915	other palms (FL)	Family Arecaceae when not listed above	
919	western soapberry	Sapindus	drummondii
920	willow	Salix	spp.
921	peachleaf willow	Salix	amygdaloides
922	black willow	Salix	nigra
927	white willow	Salix	alba

Code	Common Name	Genus	Specific epithet
931	sassafras	Sassafras	albidum
935	American mountain-ash	Sorbus	americana
936	European mountain-ash	Sorbus	aucuparia
940	Mahogany (FL)	Swietenia	mahagoni
950	basswood spp.	Tilia	spp.
951	American basswood	Tilia	americana
952	white basswood	Tilia	heterophylla
953	Carolina basswood	Tilia	americana var. caroliniana
970	elm spp.	Ulmus	spp.
971	winged elm	Ulmus	alata
972	American elm	Ulmus	americana
973	cedar elm	Ulmus	crassifolia
974	Siberian elm	Ulmus	pumila
975	slippery elm	Ulmus	rubra
976	September elm	Ulmus	serotina
977	rock elm	Ulmus	thomasii
986	black mangrove (FL)	Avicennia	germinans
987	buttonwood mangrove (FL)	Conocarpus	erectus
988	white mangrove (FL)	Laguncularia	racemosa
989	red mangrove	Rhizophora	mangle
992	melaleuca	Melaleuca	quinquenervia
993	chinaberry	Melia	azedarach
994	Chinese tallowtree	Sapium	sebiferum
995	tung-oil-tree	Aleurites	fordii
996	smoketree	Cotinus	obovatus
997	Russian olive	Elaeagnus	angustifolia
998	miscellaneous species (regional)	take a sample and consult supervisor	
999	unknown dead hardwood	UNKNOWN	UNKNOWN

DIAMETER PROCEDURES

ITEM 5092 DIAMETER AT BREAST HEIGHT (DBH) (CORE 5.09.2)

Unless one of the special situations described below is encountered, measure DBH at 4.5 ft above the ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For example, a reading of 3.68 inches is recorded as 3.6 inches.

When Collected: Trees on the 24.0 ft radius subplot, record for live and standing dead trees 5.0 inches in diameter or larger.
Trees on the 6.8 ft radius microplot, record for live trees between 1.0 inch and 4.9 inches in diameter.
Field width: 3 digits (xx.y)
Values: 001 to 999

Special DBH situations:

1. Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates below 1.0 ft, between 1.0 and 4.5 ft, or above 4.5 ft.

- Trees forked below 1.0 ft. Trees forked in this region are treated as distinctly separate trees (Figure 10). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 13 A-C). DBH is measured for each stem at 4.5 ft above the ground. When stems originate from pith intersections below 1 ft, it is possible for some stems to be within the limiting distance of the microplot or subplot, and others to be beyond the limiting distance. If stems originating from forks that occur below 1.0 ft fork again between 1.0 and 4.5 ft (Figure 13-E), the rules in the next paragraph apply.

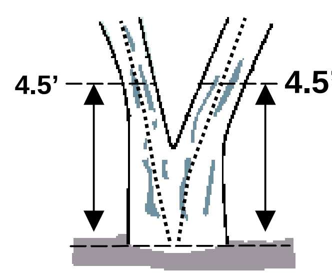


Figure 10. Forked below 1.0 ft.

- Trees forked between 1.0 ft and 4.5 ft. Trees forked in this region are also counted as separate trees (Figure 11), but only one distance and azimuth (to the central stump) is used for all (Figure 13 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in clockwise order (from front to back when one stem is directly in front of another). The DBH of each fork is measured at a

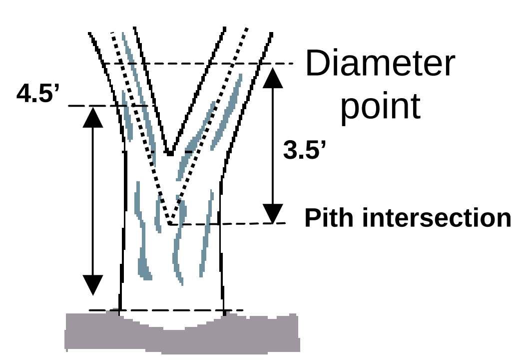


Figure 11. Forked between 1.0-4.5 ft.

point 3.5 ft above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 ft, the limiting distance is the same for all forks--they are either all on, or all off the plot.

Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 ft above the common pith intersection (Figure 13 F).

Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 ft, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems at the base of the second fork as shown in Figure 13-E (i.e., do not move the point of diameter the entire 3.5 ft above the first fork).

- <u>Trees forked at or above 4.5 ft.</u> Trees forked in this region count as one single tree (Figure 12). If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

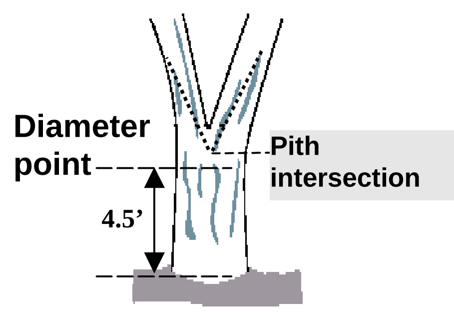


Figure 12. One tree

2. <u>Stump Sprouts</u>. Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. Stump sprouts originating between 1.0 ft and 4.5 ft are measured at 3.5 ft above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 1.0 ft. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

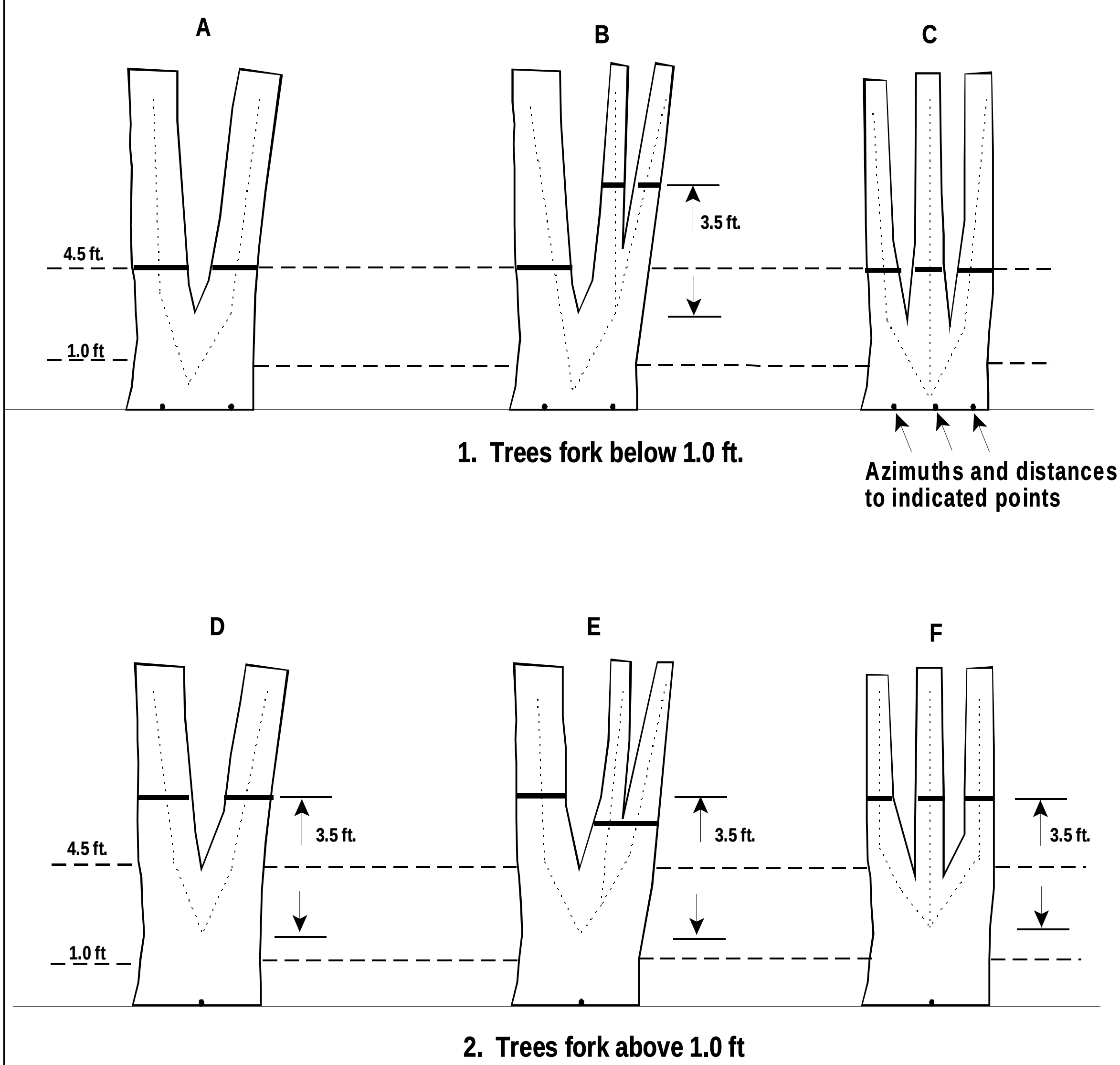


Figure 13. Summary of where to measure DBH, distance, and azimuth on forked trees.

3. Tree with butt-swell or bottleneck: Measure these trees 1.5 ft above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 ft or more above the ground (Figure 10).

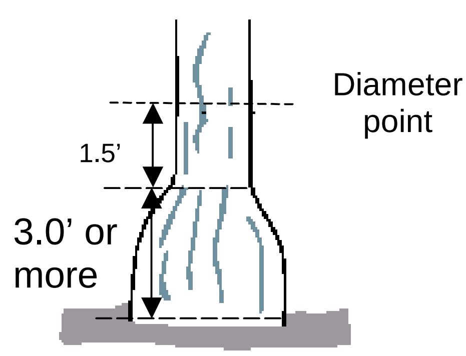


Figure 14. Tree with swelled butt

4. Tree with irregularities at DBH: On trees with swellings (Figure 13), bumps, depressions, branches (Figure 14), etc. at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

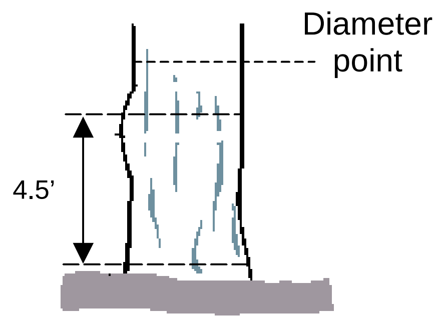


Figure 15. Tree with swelling

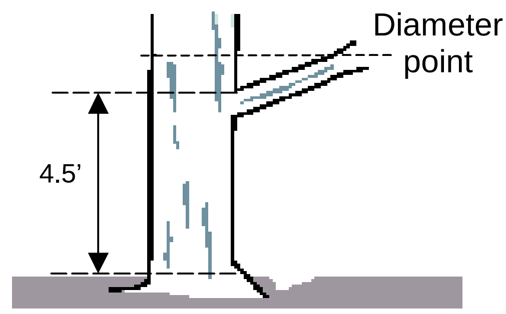


Figure 16. Tree with branch

5. Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree (Figure 15).

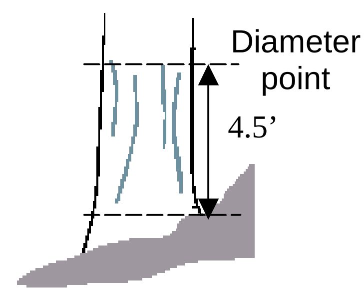


Figure 17. Tree on a slope

6. Leaning tree: Measure diameter at 4.5 ft from the ground along the bole. The 4.5 ft distance is measured along the underside face of the bole (Figure 16).

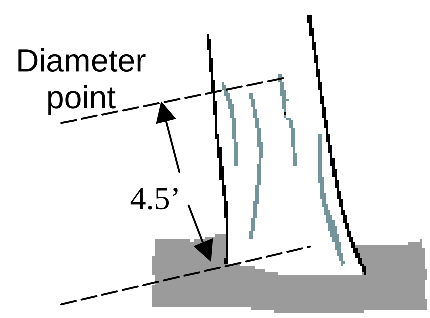


Figure 18. Leaning tree

7. Turpentine tree: On trees with turpentine face extending above 4.5 ft, estimate the diameter at 10.0 ft above the ground and multiply by 1.1 to estimate DBH outside bark.

8. Independent trees that grow together: Continue to treat them as two trees.

9. Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark at the point of measurement. Record the diameter, to the nearest 0.1, of the wood and bark that is still attached to the tree (Figure 19). If a tree has a localized abnormality (gouge, depression, etc.) at the point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 14).

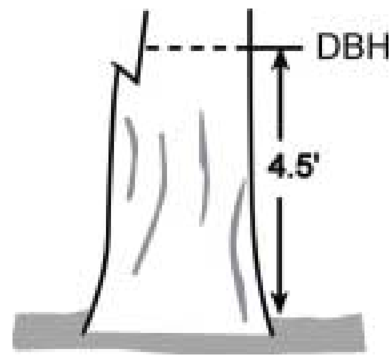


Figure 19. Tree with broken stem

10. Live windthrown tree: Measure from the top of the root collar along the length to 4.5 ft (Figure 18).

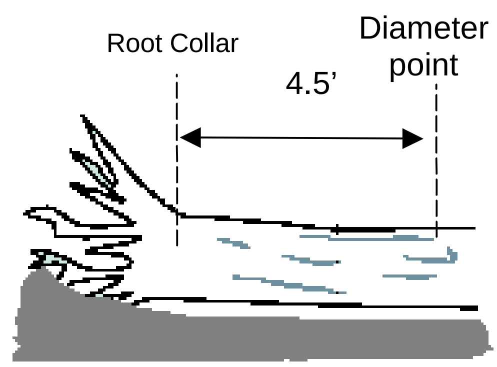


Figure 20. Tree on ground.

11. Down live tree with tree-form branches growing vertical from main bole. When a down live tree, touching the ground, has vertical (<45° from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.

- If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 21).
    - o If the pith intersection of the main down bole and vertical tree-like branch occurs below 4.5' from the stump along the main bole, treat that branch as a separate tree, and measure DBH 3.5 ' above the pith intersection for both the main bole and the tree-like branch.

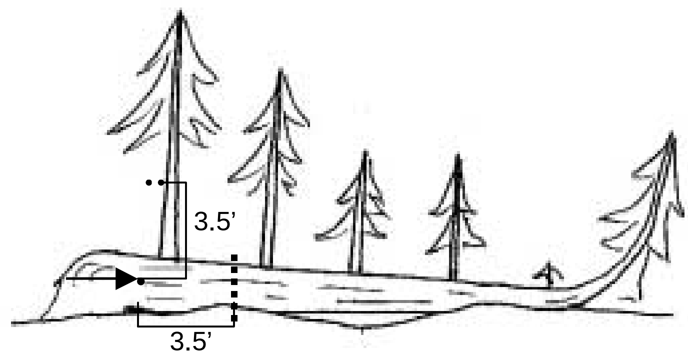


Figure 21. Down tree above duff

- o If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5' point from the stump along the main bole, treat that branch as part of the main down bole.

- If the pith of main tree bole is below the duff layer, ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 22). However, if the top of the main tree bole curves out of the ground towards a vertical angle, treat that portion of that top as an individual tree originating where the pith leaves the duff layer.

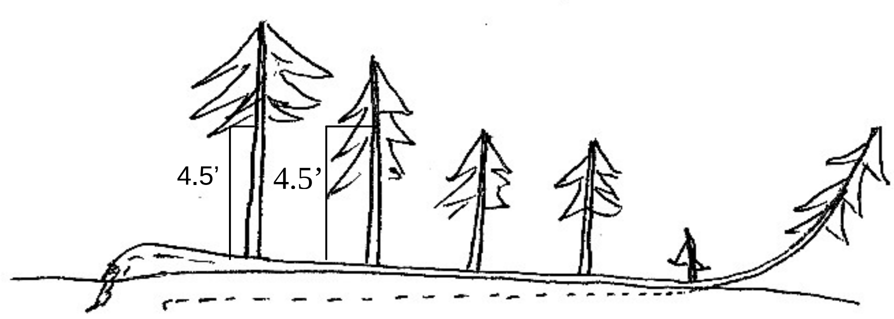
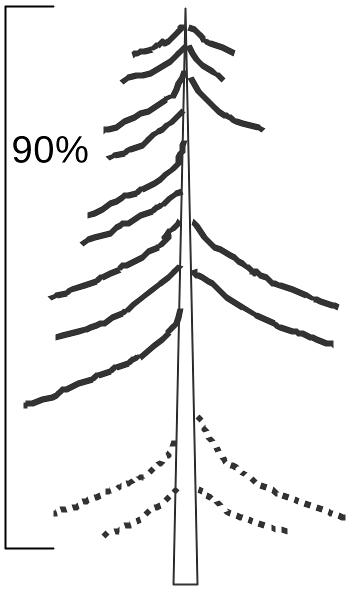


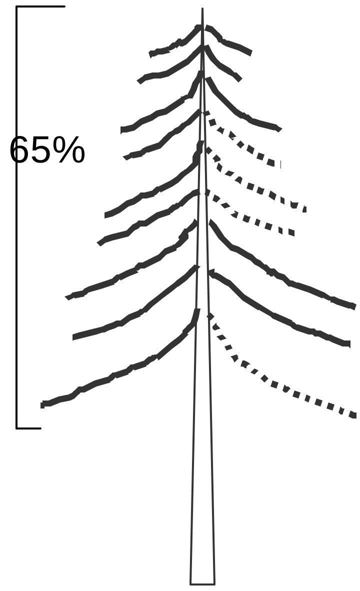
Figure 22. Down tree below duff

Open-crown conifer (e.g., ponderosa pine) –

Uncompacted:

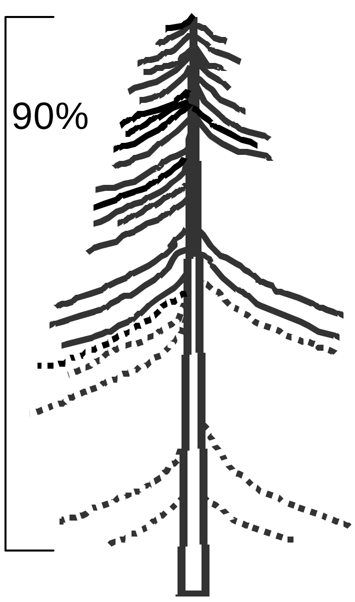


Compacted:



Dense-crown conifer (e.g., subalpine fir) –

Uncompacted:



Compacted:

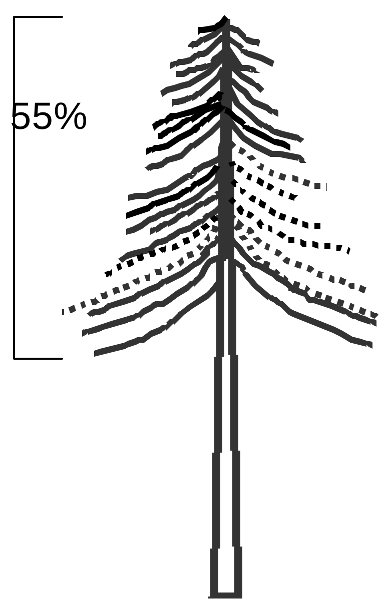


Figure 27. Examples of COMPACTED CROWN RATIO of conifers.

CUBIC FOOT CULL PROCEDURES

ITEM 5110 PERCENT ROTTEN/MISSING CULL (CORE 5.11)

Record the percent rotten or missing cubic-foot cull for all live tally trees ≥ 5.0 in DBH.

When Collected: All live tally trees ≥ 5.0 in DBH
Field width: 2 digits
Values: 00 to 99

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length.

Rotten and missing volume loss is often difficult to estimate. Refer to supplemental disease and insect pests field guides and local defect guidelines as an aid in identifying damaging agents and their impact on volume loss. Use your best judgment and be alert to such defect indicators as the following:

- Cankers or fruiting bodies.
- Swollen or punky knots.
- Dull, hollow sound of bole (use regional standards).
- Large dead limbs, especially those with frayed ends.
- Sawdust around the base of the tree.

Also cull portions of the tree that contain embedded metal objects (e.g., fencing, nails) and sections between metal objects that are less than 4 feet in length.

Cubic-Foot Volume of Short Logs

D.I.B.	Length of log or section (feet)									
midpoint	1	2	3	4	6	8	10	12	14	16
4	0.1	0.2	0.3	0.3	0.5	--	--	--	--	--
5	0.1	0.3	0.4	0.5	0.8	1.1	1.4	1.6	1.9	2.2
6	0.2	0.4	0.6	0.8	1.2	1.6	2.0	2.4	2.7	3.1
7	0.3	0.5	0.8	1.1	1.6	2.1	2.7	3.2	3.7	4.3
8	0.3	0.7	1.0	1.4	2.1	2.8	3.5	4.2	4.9	5.6
9	0.4	0.9	1.3	1.8	2.7	3.5	4.4	5.3	6.2	7.1
10	0.5	1.1	1.6	2.2	3.3	4.4	5.5	6.5	7.6	8.7
12	0.8	1.6	2.4	3.1	4.7	6.3	7.9	9.4	11.0	13.0
14	1.1	2.1	3.2	4.3	6.4	8.6	11.0	13.0	15.0	17.0
16	1.4	2.8	4.2	5.6	8.4	11.0	14.0	17.0	20.0	22.0
18	1.8	3.5	5.3	7.1	11.0	14.0	18.0	21.0	25.0	28.0
20	2.2	4.4	6.5	8.7	13.0	18.0	22.0	26.0	30.0	35.0
22	2.6	5.3	7.9	11.0	16.0	21.0	26.0	32.0	37.0	42.0
24	3.1	6.3	9.4	13.0	19.0	25.0	31.0	38.0	44.0	50.0
26	3.7	7.4	11.0	15.0	22.0	30.0	37.0	44.0	52.0	59.0
28	4.3	8.6	13.0	17.0	26.0	34.0	43.0	51.0	60.0	68.0
30	4.9	9.8	15.0	20.0	30.0	39.0	49.0	59.0	69.0	78.0
32	5.6	11.0	17.0	22.0	34.0	45.0	56.0	67.0	78.0	89.0
34	6.3	13.0	19.0	25.0	38.0	50.0	63.0	76.0	88.0	101.0
36	7.1	14.0	21.0	28.0	42.0	56.0	71.0	85.0	99.0	113.0
38	7.9	16.0	24.0	32.0	47.0	63.0	79.0	94.0	110.0	126.0
40	8.7	18.0	26.0	35.0	52.0	70.0	87.0	105.0	122.0	140.0

BOARD FOOT CULL PROCEDURES

ITEM R504 PERCENT BOARD FOOT CULL

Record the percentage of rotten and missing board-foot volume, to the nearest 1 percent. When estimating board-foot cull, only consider the cull in the sawlog portion of the tree, from a 1-ft stump to a 7-inch top for pines, from a 1-ft stump to 9-inch top on hardwoods. Do not include any cull estimate above actual length. Board foot cull cannot be coded greater than 67 percent. If the actual amount of board foot cull is greater than 67 percent, then TREE CLASS ≠2, and board foot cull is not required.

When collected: live trees with DBH ≥ 9.0 in, SPECIES < 300, and TREE CLASS = 2; live trees with DBH ≥ 11.0 in and TREE CLASS = 2
Field width: 2 digits
Values: 00-67

Board-foot cull is the volume within the entire sawlog portion of all live trees that cannot be recovered for use as lumber because of rot, sweep or crook, or other defect. Cull volume includes the entire volume of sections that do not meet minimum log grade requirements. This includes all sections less than 8 feet in length and the cull volume within sawlogs. Board foot cull is assigned for those trees receiving a tree grade, according to the section length (in feet), from a 1-foot stump to a 7-inch top in softwood or 9 inch top in hardwood.

Sweep and Crook

Estimate the length, small-end DIB, and sweep or crook departure of the affected section. If the length is 6 feet or less, treat as crook. To determine board-foot deduction, see the tables for sweep and crook in the appendix. If sweep or crook is so excessive that the section is cull, record the entire volume of the section as cull. This is the area within the heavy black lines of the sweep/crook tables.

Other Board-Foot Cull

Determine the length and the small-end DIB of the section containing decay, missing wood, fork, etc. Estimate the percentage of the section that is unusable for lumber, ties, or timber, ignoring cull defect that could normally be removed in slabbing. Apply this percentage to the total volume contained in the section, as shown in the board foot cull table.

Sawlog Stoppers

Measure the main stem to the point above which no sawlog can be produced to meet log grade standards (size and soundness) and to a minimum top of 7.0 inches DOB for softwoods and 9.0 inches DOB for hardwoods.

The sawlog cannot extend above a point where taper becomes excessive as evidenced by:

(1) A fork with less than 8 foot sawlog above it (12 feet if this is the only log in the tree)

(2) A limb with a base diameter equal to one half or more of the stem diameter below the limb, or a group of smaller limbs 2.0 inches or larger within a 1 foot section with equivalent diameter which collectively influence taper to the same degree.

Sawlog length should not extend above a sawlog section that does not meet minimum grade specifications and which has less than 8 feet of sawlog length above it (12 feet if this is the only log in the tree).

Board-Foot Volume of Short Logs

DIB small	Length of log or section (feet)									
end	1	2	3	4	6	8	10	12	14	16
6	1	2	2	3	5	8	10	13	16	19
7	1	3	4	5	8	12	15	19	24	28
8	2	4	6	8	12	17	22	27	33	39
9	3	5	8	10	16	22	29	36	43	51
10	3	7	10	13	21	29	37	46	55	65
11	4	9	13	17	26	36	46	57	68	80
12	5	10	16	21	32	44	57	69	83	97
13	6	13	19	25	39	53	68	83	99	115
14	8	15	23	30	46	63	80	98	117	136
16	10	20	31	41	62	84	108	131	158	181
18	13	26	40	53	81	109	139	169	200	232
20	17	33	50	67	102	137	174	212	251	290
22	21	41	62	82	125	169	214	259	306	354
24	25	50	74	99	151	203	257	311	368	424
26	29	59	88	118	179	241	304	368	435	501
28	35	69	104	138	210	281	356	430	507	584
30	40	80	120	160	243	325	411	497	585	674
32	46	92	137	183	278	373	470	568	669	770
34	52	104	156	208	316	423	534	644	758	872
36	59	117	176	235	356	477	601	725	853	981
38	66	132	197	263	398	533	672	811	954	1096
40	73	146	220	293	443	593	747	902	1060	1218

Crook Deduction in Board Feet

Crook departure (inches)	Crook length (feet)	Scaling diameter of section with crook (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	2	0	0	0	1	1	1	1	1	1	2	2	2	2	2
	3	1	1	1	1	1	1	2	2	2	2	3	3	3	4
	4	1	1	1	1	1	2	2	3	3	3	4	4	4	5
	5	1	1	1	1	2	2	3	3	4	4	5	5	6	6
	6	1	1	2	2	2	3	3	4	5	5	6	6	7	8
2	1	0	0	0	1	1	1	1	1	1	2	2	2	2	3
	2	1	1	1	1	1	2	2	2	3	3	4	4	4	5
	3	1	1	2	2	2	3	3	4	4	4	6	6	7	7
	4	1	1	2	2	3	3	4	5	6	7	8	8	9	10
	5	1	2	2	3	3	4	5	6	8	8	10	10	11	13
	6	2	2	3	4	4	5	7	8	9	10	13	13	14	15
3	1	0	0	1	1	1	1	2	2	2	3	3	3	3	4
	2	1	1	2	2	2	2	3	4	4	5	5	6	7	7
	3	1	2	2	3	3	4	5	6	7	8	8	9	10	11
	4	2	2	3	3	4	5	6	8	9	10	10	12	13	15
	5	2	3	4	4	5	6	8	10	11	13	13	16	17	19
	6	2	3	4	5	6	8	10	12	14	15	15	19	20	23
4	1	1	1	1	1	1	2	2	2	3	3	3	4	4	5
	2	1	2	2	2	3	3	4	5	6	7	7	8	9	10
	3	1	2	3	3	4	5	7	8	9	10	10	12	13	15
	4	2	3	4	3	5	7	9	10	12	13	13	17	18	20
	5	2	3	5	6	7	9	11	13	15	17	17	21	22	25
	6	3	5	6	7	8	11	13	15	18	20	20	25	27	30
5	1	-	-	1	2	2	2	3	3	4	4	4	5	6	6
	2	-	-	2	3	4	4	5	6	7	8	8	10	11	12
	3	-	-	4	4	5	7	8	10	11	12	12	16	17	19
	4	-	-	5	6	6	9	11	13	15	17	17	21	22	25
	5	-	-	6	7	8	11	13	16	19	21	21	26	28	31
	6	-	-	8	9	10	13	16	19	23	26	26	32	34	36
6	1	-	-	-	2	2	2	3	4	4	5	5	6	7	8
	2	-	-	-	3	4	5	6	7	9	10	10	13	13	15
	3	-	-	-	4	6	8	10	12	13	15	15	19	20	22
	4	-	-	-	7	8	10	13	15	18	20	20	25	27	30
	5	-	-	-	9	10	13	16	19	23	25	25	32	34	38
	6	-	-	-	11	13	16	20	23	27	31	31	38	41	45
8	1	-	-	-	-	-	3	5	5	6	7	7	8	9	10
	2	-	-	-	-	-	7	9	10	12	13	13	17	18	20
	3	-	-	-	-	-	10	13	16	18	20	20	25	27	30
	4	-	-	-	-	-	14	17	20	24	27	27	33	36	40
	5	-	-	-	-	-	17	22	26	30	34	34	42	45	50
	6	-	-	-	-	-	21	26	31	36	41	41	51	54	60
10	1	-	-	-	-	-	-	-	6	7	8	8	10	11	12
	2	-	-	-	-	-	-	-	12	14	16	16	21	23	25
	3	-	-	-	-	-	-	-	19	22	25	25	31	34	37
	4	-	-	-	-	-	-	-	26	29	34	34	41	45	49
	5	-	-	-	-	-	-	-	32	37	42	42	52	57	62
	6	-	-	-	-	-	-	-	39	45	51	51	63	69	75

In dashed (--) spaces, excessive sweep culls the entire section. Boxed spaces are sound for softwoods, but cull for hardwoods

Sweep Deduction in Board Feet															
Sweep departure (inches)	Sweep length (feet)	Scaling diameter of section with sweep (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
2	6	1	1	2	2	3	3	4	5	6	6	7	8	9	9
	8	1	1	2	2	3	4	5	5	6	7	8	8	9	10
	10	1	1	2	2	3	4	4	5	6	7	7	8	9	10
	12	1	1	2	2	2	3	4	4	5	6	6	6	7	8
	14	1	1	1	1	1	2	2	2	3	3	3	4	4	5
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	6	2	3	3	5	5	6	7	9	10	11	13	14	15	17
	8	2	3	4	6	6	7	9	10	12	14	15	17	19	20
	10	2	4	5	6	6	8	10	12	13	15	17	19	20	22
	12	3	4	5	7	7	9	11	12	14	16	18	19	21	23
	14	3	4	5	7	7	9	10	12	14	16	17	19	21	23
	16	3	4	5	6	6	8	10	11	13	14	16	18	19	21
4	6	3	4	5	6	7	8	11	13	15	17	18	20	22	24
	8	4	5	6	7	9	11	14	16	18	21	23	25	28	30
	10	5	6	8	9	10	13	16	19	21	24	27	29	32	35
	12	5	7	8	10	12	14	18	20	23	26	29	32	35	38
	14	6	8	9	11	12	16	19	22	25	28	31	35	38	41
	16	6	8	10	11	13	16	19	23	26	29	32	35	39	42
5	6	-	5	6	8	9	11	14	16	19	22	24	27	29	32
	8	5	7	8	10	12	15	18	21	24	27	31	34	37	40
	10	6	8	10	12	14	18	21	25	29	33	36	40	44	48
	12	8	10	12	12	16	20	25	29	33	37	41	45	50	54
	14	9	11	13	16	18	22	27	32	36	41	45	50	54	59
	16	10	12	15	17	20	24	29	34	39	44	48	53	58	63
6	6	-	-	8	9	11	14	17	20	24	27	30	33	36	39
	8	-	-	11	12	14	18	22	26	30	34	38	42	46	50
	10	-	10	13	15	18	23	27	32	36	41	46	51	56	60
	12	-	12	15	18	21	26	32	37	42	48	53	58	64	69
	14	11	15	18	20	23	29	36	41	47	53	59	65	71	77
	16	13	16	20	23	26	32	39	45	52	58	64	71	77	83
7	6	-	-	-	11	13	16	21	24	28	32	36	39	43	47
	8	-	-	-	15	17	22	27	31	36	41	46	51	56	60
	10	-	-	-	19	21	27	33	39	44	50	56	62	67	73
	12	-	-	-	22	25	32	39	45	52	58	65	71	78	84
	14	-	-	-	25	29	36	44	51	58	66	73	81	88	95
	16	-	-	24	28	33	40	49	57	64	72	80	88	96	104
8	6	-	-	-	-	-	19	24	28	33	37	41	46	50	54
	8	-	-	-	-	-	25	31	37	42	48	54	59	65	70
	10	-	-	-	-	25	32	39	46	52	59	66	72	79	86
	12	-	-	-	-	30	37	46	53	61	69	76	84	92	100
	14	-	-	-	-	34	43	52	61	69	78	87	96	105	113
	16	-	-	-	34	39	48	58	68	77	87	97	106	116	125
9	6	-	-	-	-	-	-	27	32	37	42	47	52	57	62
	8	-	-	-	-	-	29	36	42	48	55	61	68	74	80
	10	-	-	-	-	-	37	44	52	60	67	75	83	91	99
	12	-	-	-	-	-	43	52	61	70	80	88	97	106	115
	14	-	-	-	-	-	50	61	71	81	91	101	111	121	131
	16	-	-	-	-	-	57	68	79	90	102	113	124	135	146

In dashed (--) spaces, excessive sweep culls the entire section. Boxed spaces are sound for softwoods, but cull for hardwoods

TREE GRADE PROCEDURES

HARDWOOD TREE GRADES

HARDWOOD TREE GRADES			
GRADING FACTORS	**GRADE 1**	**GRADE 2**	**GRADE 3**
Length of grading zone (ft)	Butt 16	Butt 16	Butt 16
Length of grading section[a] (ft)	Best 12	Best 12	Best 12
Minimum DBH (in)	16[b]	13	11
Minimum DIB at the top of the grading section (in)	13[b] 16 20	11[c] 12	8
Clear cuttings on 3rd best face[d]			
minimum length (ft)	7 5 3	3 3	2
number on face (max)	2	2 3	unlimited
yield in face length (min)*	5/6	4/6	3/6
Cull deduction, including crook and sweep but excluding shake, maximum w/in grading section (%)	9	9[e]	50

[a] Whenever a 14- or 16-ft section of the butt log is better than the best 12-ft section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determing the grading factors, such as diameter and cull deduction.

[b] In basswood and ash, DIB at the top of the grading section may be 12-in and DBH may be 15-in.

[c] Grade 2 trees can be 10-in DIB at the top of the grading section if otherwise meeting suface requirements for small grade 1's.

[d] A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.

[e] 15% crook and sweep, or 40% total cull deduction are permitted in grade 2 if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40%.

*Minimum Yield in Face Length			
Face Length	Grade 1 Min. Yield	Grade 2 Min. Yield	Grade 3 Min. Yield
12-ft	10-ft	8-ft	6-ft
14-ft	11.7-ft	9.3-ft	7-ft
16-ft	13.3-ft	10.7-ft	8-ft

HARDWOOD TIE AND TIMBER GRADE 4	
GRADING FACTORS	**SPECIFICATIONS**
Length of grading zone (ft)	Butt 16
Scaling diameter (in)	8-in DIB and larger
Length, w/o trim (ft)	12-ft and longer
Clear cuttings	No requirements (not graded on cutting basis)
Maximum sweep allowance	One-fourth DIB of small end for half logs, and one-half DIB for logs 16-ft long
Sound surface defects -	
Single knots	Any number, if none has an average collar[a] diameter that is more than one-third of the log diameter at the point of occurrence.
Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at the point of occurrence.
Knots	Any number not exceeding knot specifica-tions, if they do not extend more than 3-in into the contained tie or timber.
Unsound surface defects[b]	Any number and size, if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound defects.

[a] Knot collar is the average of the vertical and horizontal diameters of the limb, or knot swelling, as measured flush with the surface of the log.

[b] Interior defects are not visible in standing trees. They are considered in grading cut logs. No interior defects are permitted except one shake not more than one-third the width of the contained tie or timber, and one split not more than 5-in long.

HARDWOOD TREE GRADE 5

Record TREE GRADE 5 for hardwood species that do not meet the length of grading zone requirement for TREE GRADE 1-4, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

These logs must still meet the size, soundness and surface yield requirements for a grade 1-4 log. The only difference is that the length of the grading zone extends beyond the butt 16-foot log.

Since these logs are in the upper portion of the tree, determining the surface yield is impractical. When determining if TREE GRADE = 5, simply make sure the log appears to meet the size and soundness requirements of a TREE GRADE 4 (no internal rot). If it is clear the upper log does have internal rot, then it must be examined further to determine if it can at least meet the size, soundness and surface yield requirements of a TREE GRADE 3 (the log must be at least 8 inches DIB, with no more than 50% board foot cull in the section, at least 3/6 of the section length clear of defects, and at least 2 feet between defects.)

Log abnormalities that are defects in factory logs include the following:

- Adventitious bud clusters
- Bulge, butt or stem
- High bumps
- Burl
- Butt scar
- Canker
- Conk
- Flutes, if not superficial
- Holes extending into the bole
- Embedded metal (fence)
- Limb
- Knots
- Knot overgrowths
- Low bumps
- Overgrowths following insect damage or bird peck*
- Seams, if not superficial
- Wounds extending into the bole

Bird pecks: There must be four bird pecks within a square foot to affect the tree grade. First, determine the tree grade without the bird pecks. If the tree grade is determined to be 1 or 2, then down grade the tree by one grade. If the tree graded out to be a 3 or 4 without the bird pecks, then ignore them as defects and record the initial tree grade.

Abnormalities not ordinarily limiting cuttings are butt swell, flanges and surface rise.

SOUTHERN PINE TREE GRADES

SOUTHERN PINE TREE GRADES All pines except eastern white pine. Includes red cedar and cypress.			
FACE LENGTH	**GRADE 1**	**GRADE 2**	**GRADE 3**
Butt 16-ft*	3 or 4 clear faces	1 or 2 clear faces	No clear faces

After the tentative grade is established, the tree will be ***reduced one grade*** for each of the following:

Sweep - Degrade any tentative Grade 1 or 2 tree one grade if sweep in the lower 12-ft of the grading section amounts to 3 or more inches and equals or exceeds one-fourth the DBH.

Heart rot - Degrade any tentative Grade 1 or 2 tree one grade if conks, punk knots, or other evidence of advanced heart rot is found anywhere on the tree stem.

Note - No tree can be degraded below Grade 3, provided the total scaling deductions for sweep and/or rot do not exceed two-thirds the gross scale of the tree. Trees with total scaling deductions in excess of two-thirds are classified as cull (Tree Class 3 or 4).

A face is one-fourth the circumference of the 16-ft grading section and extends the full length of the grading section. Clear faces are those free from knots measuring more than 1/2-inch in diameter, overgrown knots of any size, and holes more than1/4-inch in diameter. Faces may be rotated, if necessary to obtain the maximum number of clear faces on the grading section.

*Note: Only grade the length of the log up to a 7-inch top DOB. The 7-inch top DOB must be between 12-16 feet off of the 1ft stump to be coded TREE CLASS 2.

SOUTHERN PINE TREE GRADE 5

Record TREE GRADE 5 for southern pine species that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

EASTERN WHITE PINE TREE GRADES

EASTERN WHITE PINE TREE GRADES				
GRADING FACTORS	**GRADE 1**	**GRADE 2**	**GRADE 3**	**GRADE 4**
Minimum DBH (in)	9	9	9	9
Maximum weevil injury in butt 16-ft section (number)	None	None	2 Injuries	No limit
Minimum face requirements on butt 16-ft section	Two full length or four 50% length good faces[1]. (In addition, knots on balance of faces shall not exceed size limitations for Grade 2 sections.)	NO GOOD FACES REQUIRED. Maximum diameter of knots on 3 best faces: **SOUND RED KNOTS** not to exceed 1/6 of scaling diameter or 3-in maximum[2]. **DEAD OR BLACK KNOTS**, including overgrown knots, not to exceed 1/12 scaling diameter and 1-1/2-in maximum	NO GOOD FACES REQUIRED. Maximum diameter of knots on 3 best faces: **SOUND RED KNOTS** not to exceed 1/3 of scaling diameter of 5-in maximum[2]. **DEAD OR BLACK KNOTS**, including overgrown knots, not to exceed 1/6 scaling diameter and 2-1/2-in maximum	Includes all trees not qualifying for Grade 3 or better and judged to have at least 1/3 of their gross volume in sound wood suitable for manufacture into standard lumber.
Maximum sweep or crook in butt 16-ft section (%)	20	30	40	No limit
Maximum total scaling deduction in 16-ft section (%)	50	50	50	No limit

After the tentative grade of the section is established from face examination, the section will be ***reduced one grade*** whenever the following defects are evident[3]:

CONKS, PUNK KNOTS AND PINE BORER DAMAGE ON THE SURFACE OF THE SECTION

Degrade one grade if present on one face.
Degrade two grades if present on two faces.
Degrade three grades if present on three to four faces.

If the final grade of the grading section is 1, 2 or 3, examine the tree for weevil injuries in the merchantable stem ***above*** 16-ft. If the total apparent weevil damage exceeds 3, degrade the tree grade one below the section grade[3]. Otherwise the tree grade is the same as the final section grade.

[1] Trees under 16-in DBH require four full length good faces.
[2] Scaling diameter is estimated at the top of the 16-ft grading section.
[3] No tree will be designated below Grade 4 unless net tree scale is less than one-third of gross tree scale.

White Pine Collar Diameter Limits for Red & Black Knots			
Scaling Diameter (DIB in)	**Black Knots 1/12**	**Black & Red Knots 1/6**	**Red Knots 1/3**
7	7/12"	1-1/6"	2-1/3"
8	2/3"	1-1/3"	2-2/3"
9	3/4"	1-1/2"	3"
10	5/6"	1-2/3"	3-1/3"
11	11/12"	1-5/6"	3-2/3"
12	1"	2"	4"
13	1-1/12"	2-1/6"	4-1/3"
14	1-1/6"	2-1/3"	4-2/3"
15	1-1/4"	**2-1/2" Black Max**	**5" Max**
16	1-1/3"	2-2/3"	**5" Max**
17	1-5/12"	2-5/6"	**5" Max**
18	**1-1/2" Max**	**3" Red Max**	**5" Max**

EASTERN WHITE PINE TREE GRADE 5

Record TREE GRADE 5 for eastern white pine trees that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

SPRUCE, FIR, WHITE-CEDAR, TAMARACK AND HEMLOCK

SPRUCE, FIR, WHITE-CEDAR, TAMARACK AND HEMLOCK Minimum Merchantability Specifications for Grade 1				
DIB (small end of log)	**Length (2-ft multiples w/o trim)**	**Total Deduction**	**Sweep Permitted**	**Other Requirements***
6" - 12"	12' - 16'	50%	25%	Not more than one sound knot or branch greater than 2" in diameter.
13" +	12' - 16'	50%	25%	Not more than one sound knot or branch greater than 3" in diameter.

If the tree does not meet the specifications for a grade 1, but does have a 12-foot log in the butt 16-foot section, then record TREE GRADE = 4.

SPRUCE, FIR, WHITE-CEDAR, TAMARACK AND HEMLOCK TREE GRADE 5

Record TREE GRADE 5 for trees that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

TREE DAMAGE PROCEDURES

OVERVIEW

Record up to two different damages per tree. Damage is characterized according to three attributes: location of damage, type of damage, and severity of damage. Damages must meet severity thresholds in order to be recorded.

The tree is observed from all sides starting at the roots. Damage signs and symptoms are prioritized and recorded based on location in the following order: roots, roots and lower bole, lower bole, lower and upper bole, upper bole, crownstem, and branches (DAMAGE LOCATION 1-9). No damage is recorded as location code 0.

Within any given location, the hierarchy of damage follows the numeric order of DAMAGE TYPE possible for that location. The numeric order denotes decreasing significance as the code number goes up, i.e., DAMAGE TYPE 01 is more significant than DAMAGE TYPE 25. A maximum of two damages are recorded for each tree. If a tree has more than two damages that meet the threshold levels, the first two that are observed starting at the roots are recorded.

PROCEDURES TO RECORD MULTIPLE DAMAGES AT THE SAME LOCATION

When multiple damages occur in the same place, the most damaging is recorded. For example, if a canker, DAMAGE TYPE 01, meets the threshold and has a conk growing in it, record only the canker. Another example: if an open wound meets threshold and also has resinosis, record only the open wound.

PROCEDURES TO RECORD MULTIPLE OCCURRENCES OF THE SAME DAMAGE

Damage codes 01 (canker), 03 (open wounds), and 04 (resinosis/gummosis) must meet a threshold of 20 percent of the circumference at the point of occurrence, within any 3-ft section. Multiple cankers or open wounds which are directly above one another pose no more threat to long term tree survival than would a single damage incidence of the same width. However, should multiple damages be located horizontally within any 3-ft section, the translocation of water and nutrients would be significantly affected. The widths of each individual damage are added and compared as a percent, to the total circumference at the midpoint of the 3-ft section (Figure 24).

PROCEDURES TO MEASURE CIRCUMFERENCE AFFECTED

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40% of the circumference of a face can be observed at any one time. The damage is measured horizontally between the margins. If the cumulative area affected within a 3-ft section exceeds 1/2 of any face, then the 20% minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10% classes. If in doubt, measure the damage and circumference at the widest point of occurrence on the bole with a linear tape, and determine the percent affected.

ITEMS 5181, 5184 DAMAGE LOCATION 1, 2 (CORE 5.18.1, 5.18.4)

Record the location on the tree where DAMAGE TYPE is found (Figure 23). If the same damage continues into two or more locations, record the appropriate code listed below, or if the combination of locations does not exist (damage extends from crownstem to roots), record the lowest location that best describes the damage (see Figure 24). Multiple damages may occur in the same location, but record the higher priority damage (lower code number) first. If the damages are coincident (a conk within a canker), record only the higher priority damage.

The "base of the live crown" is defined as the horizontal line which would touch the lowest part of the foliage, excluding branches towards the base of the tree which are less than 1.0 inch, or more than 5 ft from the rest of the crown.

When Collected: **P3 PLOTS ONLY:** All live tally trees $\geq$ 5.0 in DBH
Field width: 1 digit
Values:

0 No damage

1 Roots (exposed) and stump (12 inches in height from ground level)

2 Roots, stump, and lower bole

3 Lower bole (lower half of the trunk between the stump and base of the live crown)

4 Lower and upper bole

5 Upper bole (upper half of the trunk between stump and base of the live crown)

6 Crownstem (main stem within the live crown area, above the base of the live crown)

7 Branches (>1 in at the point of attachment to the main crown stem within the live crown area)

8 Buds and shoots (the most recent year's growth)

9 Foliage

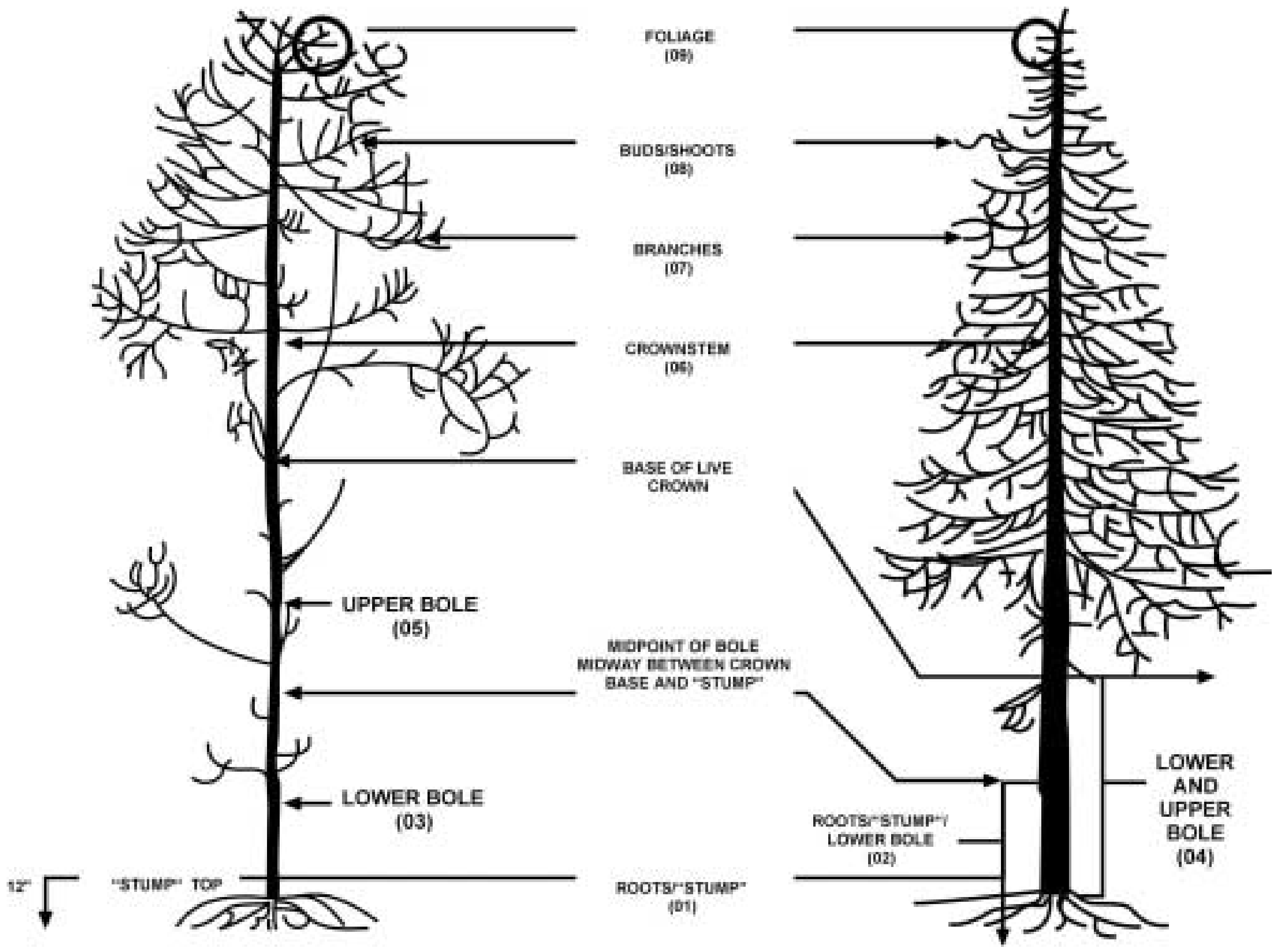


Figure 23. Location codes for damage.

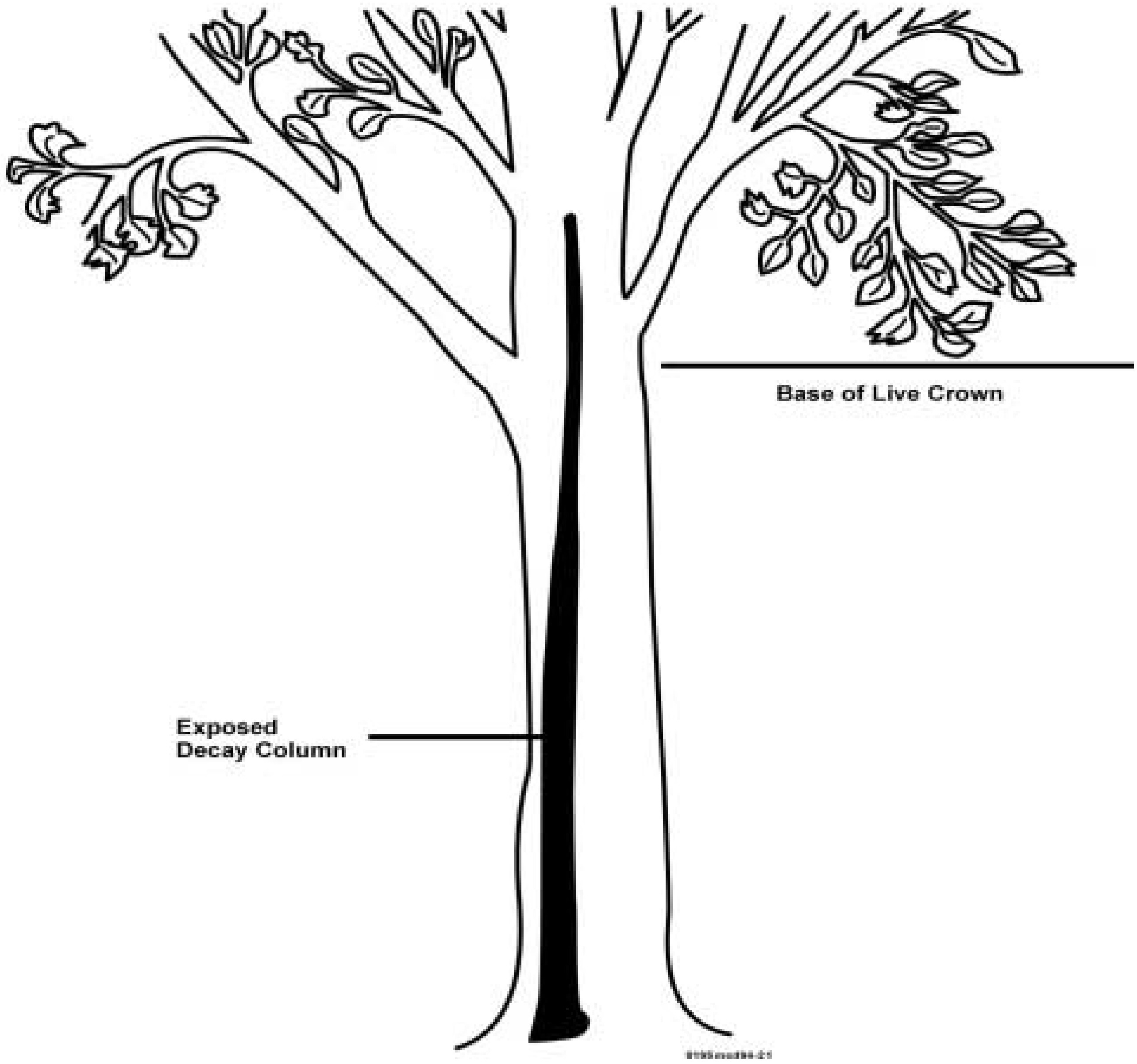


Figure 24. The damage runs from stump to crownstem. Code here should be 02 (roots and "stump" and llower bole) which represents the lowest locations of this multi-location damage.

ITEMS 5182, 5185 DAMAGE TYPE 1, 2 (CORE 5.18.2, 5.18.5)

Record the first damage type observed that meets the damage threshold definition in the lowest location. Damage categories are recorded based on the numeric order that denotes decreasing significance from damage 01-31.

When Collected: **P3 PLOTS ONLY:** All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
Values:

1 Canker, gall: Cankers may be caused by various agents but are most often caused by fungi. The bark and cambium are killed, and this is followed by death of the underlying wood, although the causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider, or galling (including galls caused by rusts), on roots, bole, or branches. Due to the difficulty in distinguishing some abnormal swellings (e.g., burls) from classic galls and cankers, all are recorded as damage 01. A canker may be:

Annual (enlarges only once and does so within an interval briefer than the growth cycle of the tree, usually less than one year),

Diffuse (enlarges without characteristic shape or noticeable callus formation at margins), or

Perennial (enlarges during more than one year - often has a target appearance).

2 Conks, fruiting bodies, and signs of advanced decay: Fruiting bodies on the main bole, crownstem, and at the point of the branch attachment are signs of decay. "Punky wood" is a sign of decay and is evidenced by soft, often moist, and degraded tissue.

Cavities into the main bole that are oriented in such a way that they act as catchment basins for water are signs of decay. Bird cavities are signs of decay.

Rotten branches or branches with conks **are not indicators of decay unless** the threshold is met (>20% of branches are affected).

Rotting stumps associated with coppice regeneration (e.g., northern pin oak, maple) are excluded from coding.

3 Open wounds: An opening or series of openings where bark has been removed or the inner wood has been exposed and no signs of advanced decay are present. Improper pruning wounds that cut into the wood of the main stem are coded as open wounds, if they meet the threshold; those which leave the main stemwood intact are excluded.

4 Resinosis or gummosis: The origin of areas of resin or gum (sap) exudation on branches and trunks.

5 Cracks and seams: Cracks in trees are separations along the radial plane. When they break out to the surface they often are called frost cracks. These cracks are not caused by frost or freezing temperature, though frost can be a major factor in their continued development. Cracks are most often caused by basal wounds or sprout stubs, and expand when temperatures drop rapidly. Seams develop as the tree attempts to seal the crack, although trees have no mechanism to compartmentalize this injury.

Lightning strikes are recorded as cracks when they do not meet the threshold for open wounds.

11 Broken bole or roots (less than 3 ft from bole): Broken roots within 3 ft from bole either from excavation or rootsprung for any reason. For example, those which have been excavated in a road cut or by animals.

Stem broken in the bole area (below the base of the live crown) and tree is still alive.

12 Brooms on roots or bole: Clustering of foliage about a common point on the trunk. Examples include ash yellows witches' brooms on white and green ash and eastern and western conifers infected with dwarf mistletoes.

13 Broken or dead roots (beyond 3 ft): Roots beyond 3 ft from bole that are broken or dead.

20 Vines in the crown: Kudzu, grapevine, ivy, dodder, etc. smothers tree crowns. Vines are rated as a percentage of tree crown affected.

21 Loss of apical dominance, dead terminal: Mortality of the terminal of the crownstem caused by frost, insect, pathogen, or other causes.

22 Broken or dead: Branches that are broken or dead. Branches with no twigs are ignored and not coded as dead. Dead or broken branches attached to the bole or crownstem outside the live crown area are not coded. 20% of the main, first order portion of a branch must be broken for a branch to be coded as such.

23 Excessive branching or brooms within the live crown area: Brooms are a dense clustering of twigs or branches arising from a common point that occur within the live crown area. Includes abnormal clustering of vegetative structures and organs. This includes witches' brooms caused by ash yellows on green and white ash and those caused by dwarf mistletoes.

On deciduous trees, only record codes 24 and 25 from June-August.

24 Damaged buds, foliage or shoots: Insect feeding, shredded or distorted foliage, buds or shoots >50% affected, on at least 30% of foliage, buds or shoots. Also includes herbicide or frost-damaged foliage, buds or shoots.

25 Discoloration of foliage: At least 30% of the foliage is more than 50% affected. Affected foliage must be more of some color other than green. If the observer is unsure if the color is green, it is considered green and not discolored.

31 Other: Use when no other explanation is appropriate. Specify in comments section of PDR for "tree notes." Code 31 is used to maintain consistency with the Phase 3 crown damage protocols.

LEGAL COMBINATIONS OF DAMAGE TYPE BY DAMAGE LOCATION:

For each of the following location codes, possible damage codes and damage definitions are presented.

Location 1: Roots and stump

- 01 Canker, gall -- exceeds 20% of circumference of stump
- 02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
- 03 Open wounds -- exceeds 20% of circumference of stump
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference of stump
- 05 Cracks and seams -- any occurrence
- 11 Broken bole or roots less than 3 ft from bole -- any occurrence
- 12 Brooms on roots or bole -- any occurrence.
- 13 Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead
- 31 Other

Location 2: Roots, stump, and lower bole

- 01 Canker, gall -- exceeds 20% of circumference of stump
- 02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
- 03 Open wounds – exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of the circumference of stump
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of circumference of stump.
- 05 Cracks and seams - any occurrence
- 11 Broken bole or roots less than 3 ft from bole -- any occurrence
- 12 Brooms on roots or bole - -any occurrence.
- 13 Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead
- 31 Other

Location 3: Lower bole

- 01 Canker, gall -- exceeds 20% of circumference at the point of occurrence
- 02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
- 03 Open wounds -- exceeds 20% of circumference at the point of occurrence
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
- 05 Cracks and seams -- any occurrence
- 11 Broken bole or roots less than 3 ft from bole -- any occurrence
- 12 Brooms on roots or bole -- any occurrence
- 31 Other

Location 4: Lower and upper bole -- same as lower bole.

Location 5: Upper bole - same as lower bole.

Location 6: Crownstem

- 01 Canker, gall -- exceeds 20% of circumference of crownstem at the point of occurrence
- 02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
- 03 Open wounds - exceeds 20% of circumference at the point of occurrence -- any occurrence
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
- 05 Cracks and seams -- all woody locations -- any occurrence.
- 21 Loss of apical dominance, dead terminal -- any occurence
- 31 Other

Location 7: Branches >1 in at the point of attachment to the main or crown stem

- 01 Canker, gall -- exceeds 20% of circumference on at least 20% of branches
- 02 Conks, fruiting bodies and signs of advanced decay -- more than 20% of branches affected
- 03 Open wounds -- exceeds 20% of circumference at the point of occurrence on at least 20% of branches
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence on at least 20% of branches
- 05 Cracks and seams -- all occurrences, and on at least 20% of branches
- 20 Vines in the crown -- more than 20% of live crown affected
- 22 Broken or dead -- more than 20% of branches affected within the live crown area
- 23 Excessive branching or brooms -- more than 20% of branches affected
- 31 Other

Location 8: Buds and shoots

- 24 Damaged buds, shoots or foliage - more than 30% of buds and shoots damaged more than 50%.
- 31 Other

Location 9: Foliage

- 24 Damaged buds, shoots or foliage - more than 30% of foliage damaged more than 50%.
- 25 Discoloration of foliage - more than 30% of foliage discolored more than 50%.
- 31 Other

ITEMS 5183, 5186 DAMAGE SEVERITY 1, 2 (CORE 5.18.3, 5.18.6)

Record a code to indicate the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for TREE DAMAGE 1. Severity codes vary depending on the type of damage recorded.

When Collected: **P3 PLOTS ONLY:** All tally trees where DAMAGE LOCATION 1 > 0

Field width: 2 digits

Values: The codes and procedures for SEVERITY 1 values are defined for each DAMAGE TYPE 1.

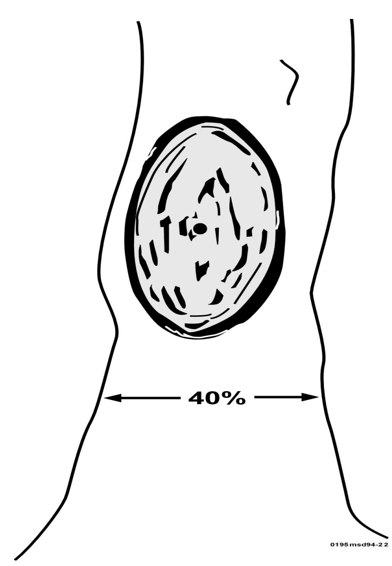
DAMAGE TYPE Code 01 -- Canker, gall

Measure the affected area from the margins (outer edges) of the canker or gall within any 3-ft vertical section in which at least 20% of circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 25.

Severity classes for code 01 (percent of circumference affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

Figure 25. A canker which exceeds threshold. Since 40% of circumference is visible from any side, and since over half the visible side is taken up by the canker, it obviously exceeds the 20% minimum circumference threshold.



DAMAGE TYPE Code 02 -- Conks, fruiting bodies, and signs of advanced decay

Severity classes for code 02: **None**. Enter code 0 regardless of severity, except for roots > 3 ft from the bole, or number of branches affected - 20%

DAMAGE TYPE Code 03 -- Open wounds

The damaged area is measured at the widest point between the margins of the exposed wood within any 3-ft vertical section in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 26.

Severity Classes for code 03 (percent of circumference affected):

Code	Classes
2	20-29
3	30-39
4	40-49
5	50-59
6	60-69
7	70-79
8	80-89
9	90-99

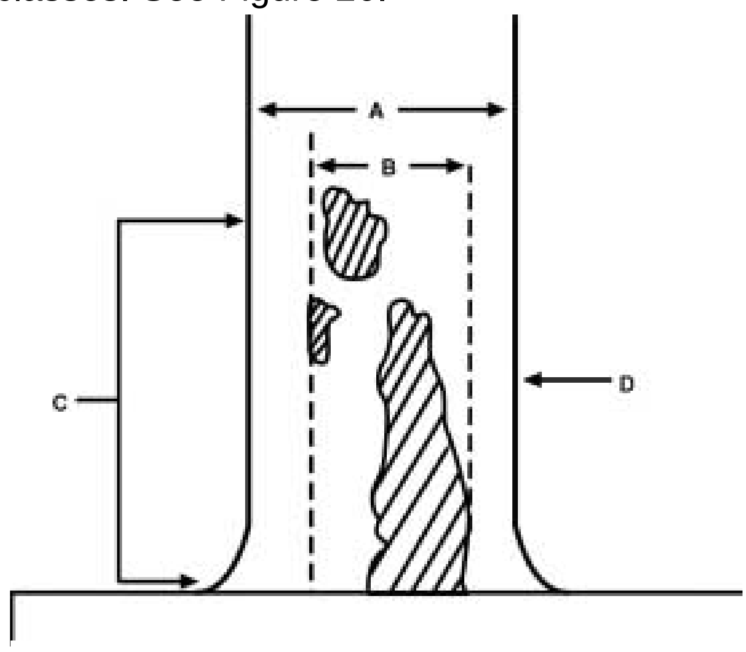


Figure 26. Multiple damage in "stump" and lower bole. A=approximately 40% of tree circumference; B=portion of tree circumference affected by damage; C=vertical distance within one meter; D=midpoint of occurence at which circumference is measured.

DAMAGE TYPE Code 04 -- Resinosis or gummosis

Resinosis or gummosis is measured at the widest point of the origin of the flow width in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

Severity classes for code 04 (percent of circumference affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

DAMAGE TYPE Code 05 -- Cracks and seams

Severity class for code 05

Seam must be > 5 feet long. Record severity code 0 for the lowest location in which the crack occurs. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

DAMAGE TYPE Code 11 -- Broken bole or roots less than 3 ft from bole

Severity classes for code 11: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 12 -- Brooms on roots or bole

Severity classes for code 12: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 13 -- Broken or dead roots

At least 20% of roots beyond 3 ft from bole that are broken or dead.

Severity classes for code 13 (percent of roots affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

DAMAGE TYPE Code 20 -- Vines in crown

Severity classes for code 20 (percent of live crown affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

DAMAGE TYPE Code 21 -- Loss of apical dominance, dead terminal

Any occurrence (> 1%) is recorded in 10% classes as a percent of the crownstem affected. Use trees of the same species and general DBH/DRC class in the area or look for the detached portion of the crownstem on the ground to aid in estimating percent affected. If a lateral branch has assumed the leader and is above where the previous terminal was, then no damage is recorded.

Severity classes for code 21:

Code	Classes	Code	Classes
0	01-09	5	50-59
1	10-19	6	60-69
2	20-29	7	70-79
3	30-39	8	80-89
4	40-49	9	90-99

DAMAGE TYPE Code 22 -- Broken or dead branches (> 1in above the swelling at the point of attachment to the main or crown stem within the live crown area)

At least 20% of branches are broken or dead.

Severity classes for code 22 (percent of branches affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

DAMAGE TYPE Code 23 -- Excessive branching or brooms

At least 20% of crownstem or branches affected with excessive branching or brooms.

Severity classes for code 23 (percent of area affected):

Code	Classes	Code	Classes
2	20-29	6	60-69
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99

DAMAGE TYPE Code 24 - Damaged buds, shoots or foliage

At least 30% of the buds, shoots or foliage (i.e., chewed or distorted) are more than 50% affected.

Severity classes for code 24:

Code	Classes	Code	Classes
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99
6	60-69		

DAMAGE TYPE Code 25 - Discoloration of Foliage

At least 30% of the foliage is more than 50% affected.

Severity classes for code 25 (percent affected):

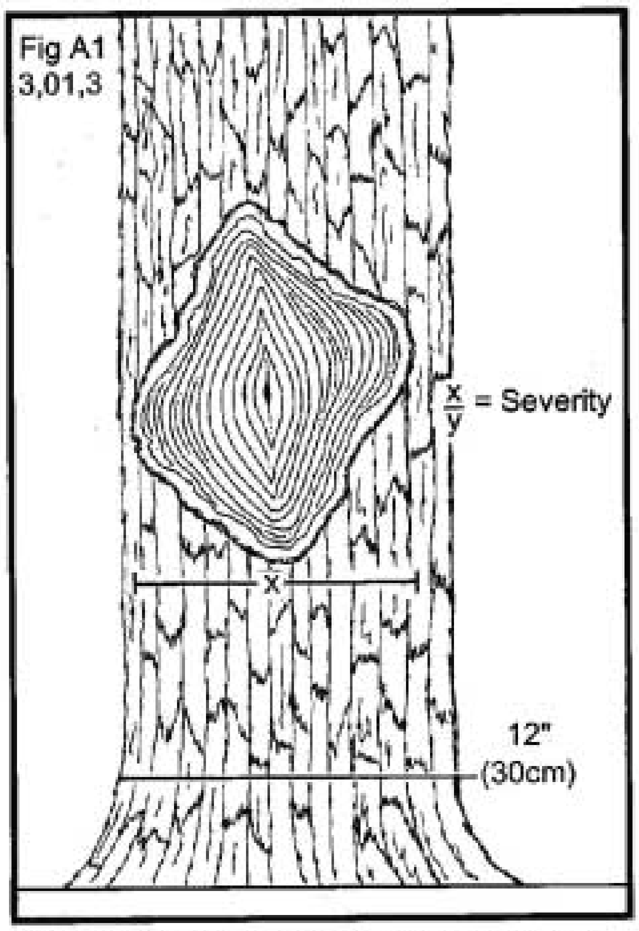
Code	Classes	Code	Classes
3	30-39	7	70-79
4	40-49	8	80-89
5	50-59	9	90-99
6	60-69		

DAMAGE TYPE Code 31 -- Other

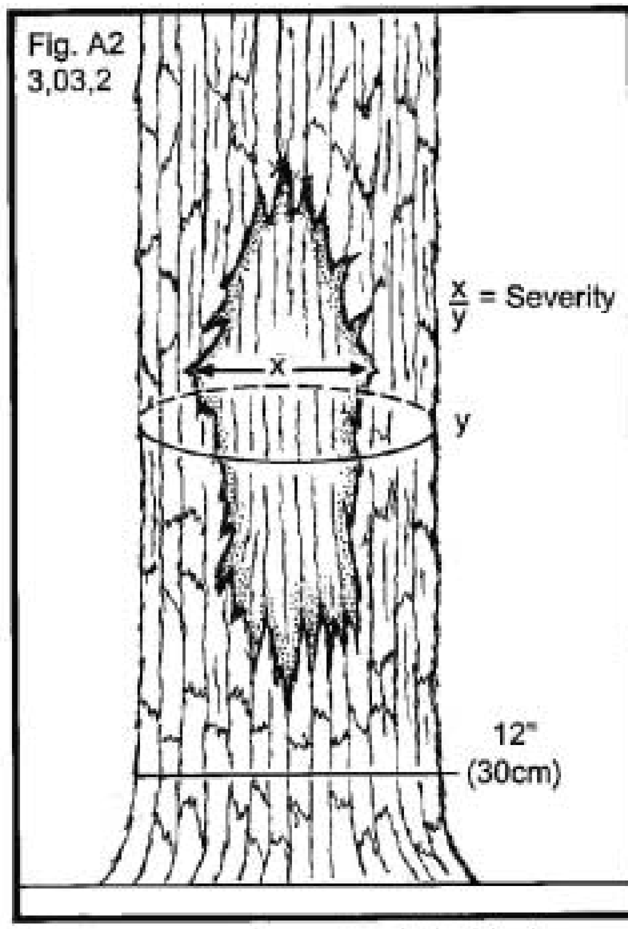
Severity classes for code 31:

None. Enter code 0 regardless of severity. Describe condition in tree notes.

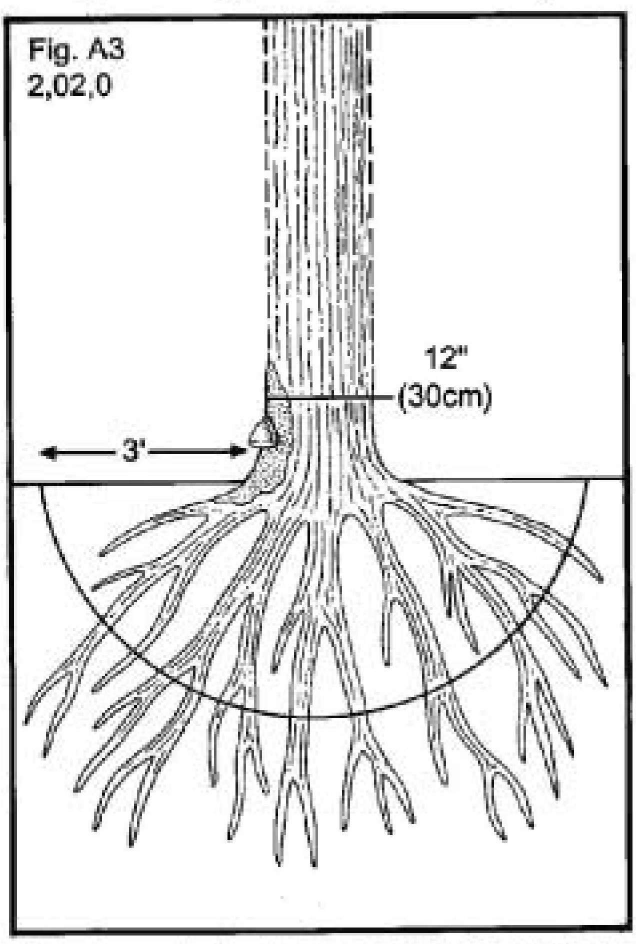
Examples are shown in Figures 33-39.



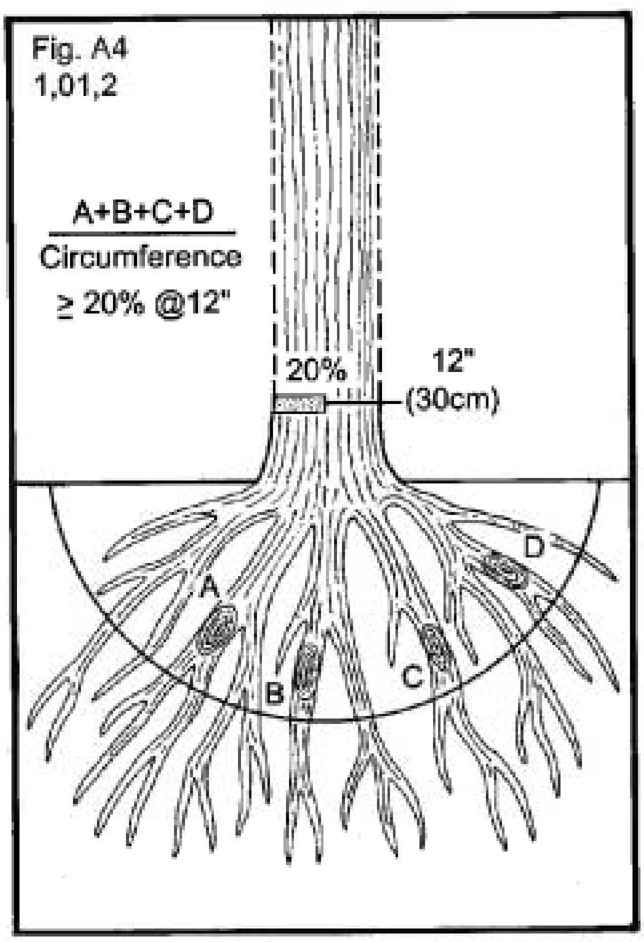
01 - Canker measured as widest distance between the outside of canker swelling (refer to Fig. 2 for y measurement)



03 - Open wound measured at widest point inside of wound margins

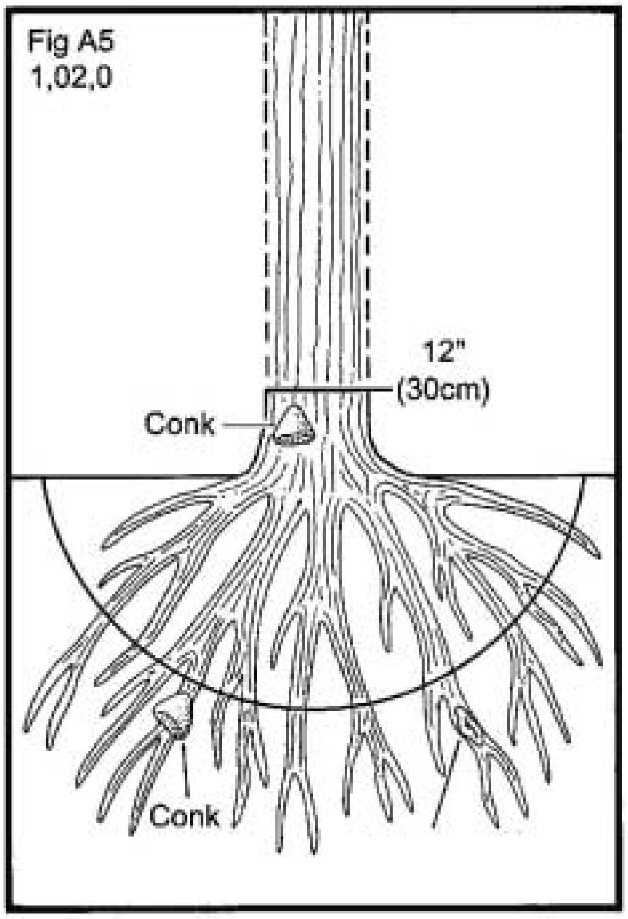


02 - Decay indicator on roots and lower bole

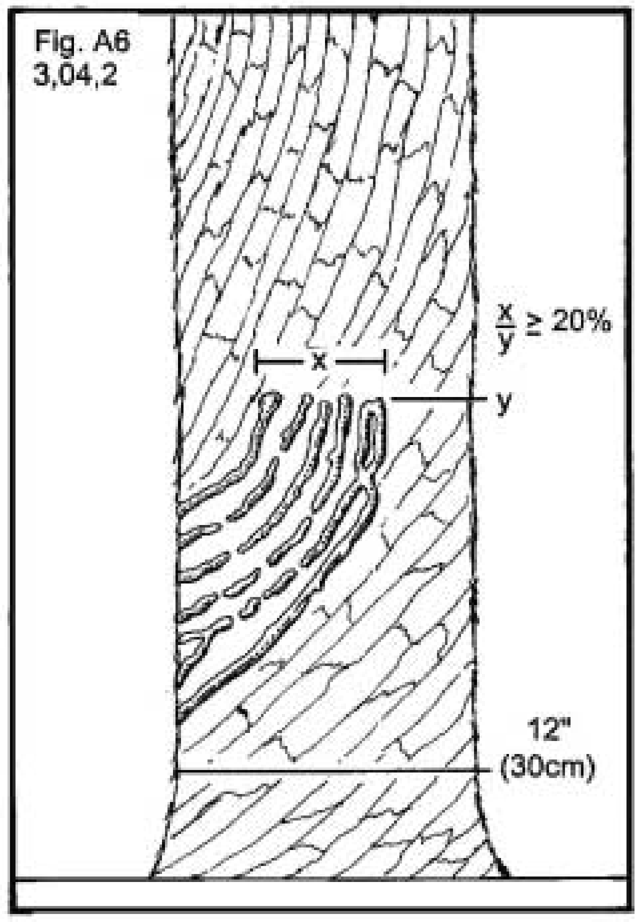


01 - Canker / gall on roots (within 3' of bole)

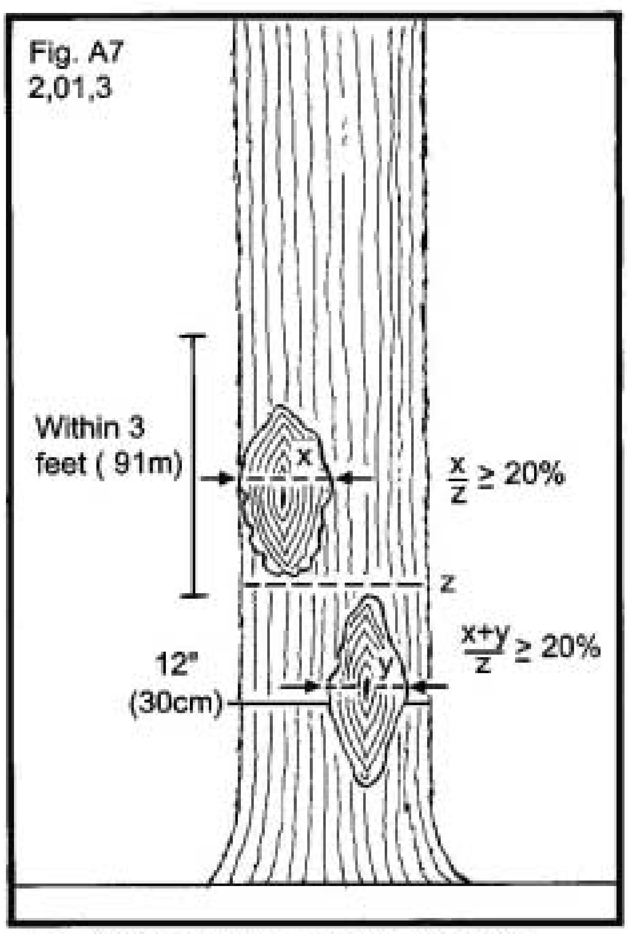
Figure 33. Examples of damage coding.



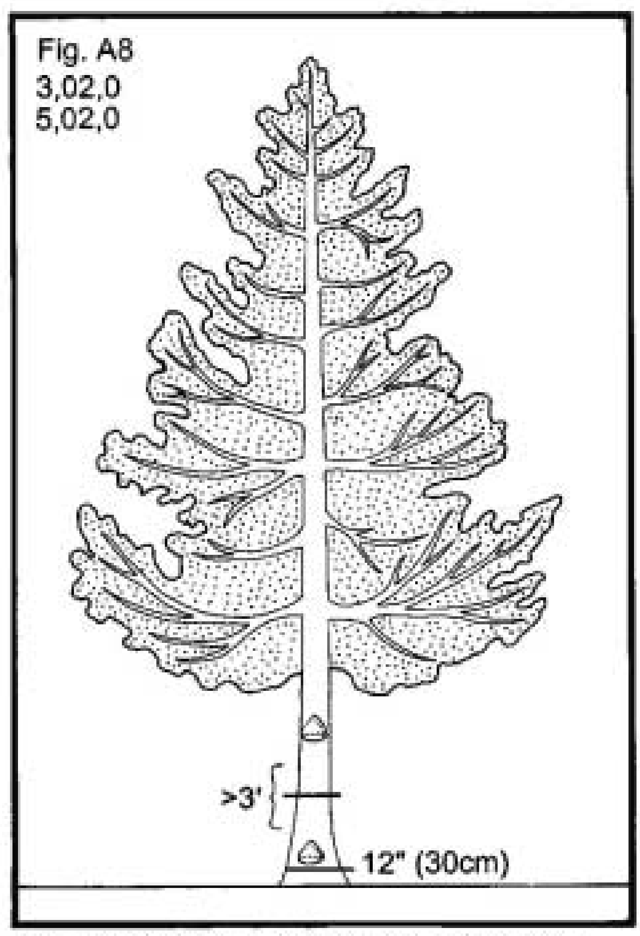
02 - Indicator of decay within 3' of bole. Beyond 3" of bole, indicators must affect ≥ 20% of roots (see fig. 12)



04 - Origin of resinosis in lower bole

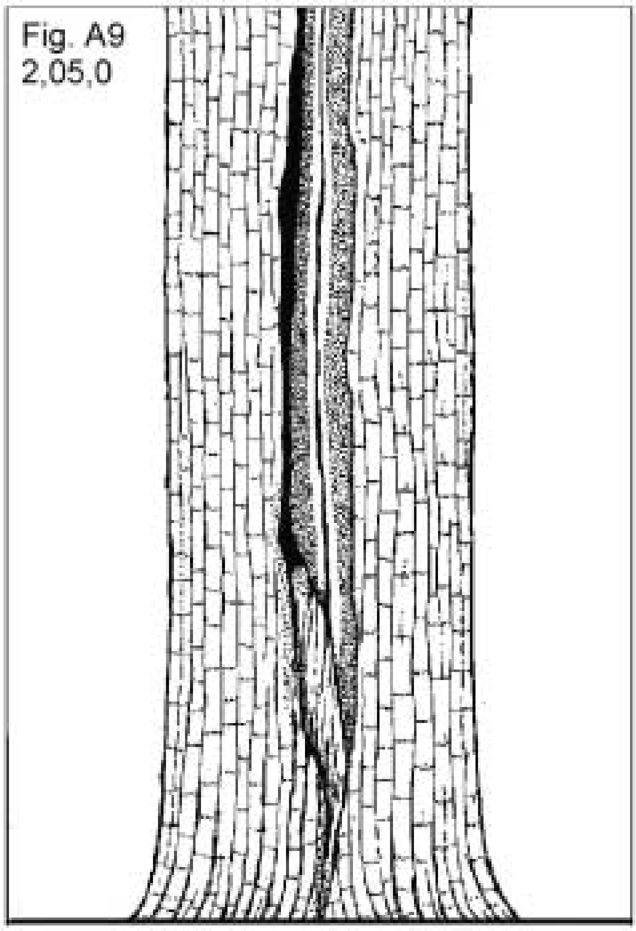


01 - Additive cankers within 3' in roots and lower bole

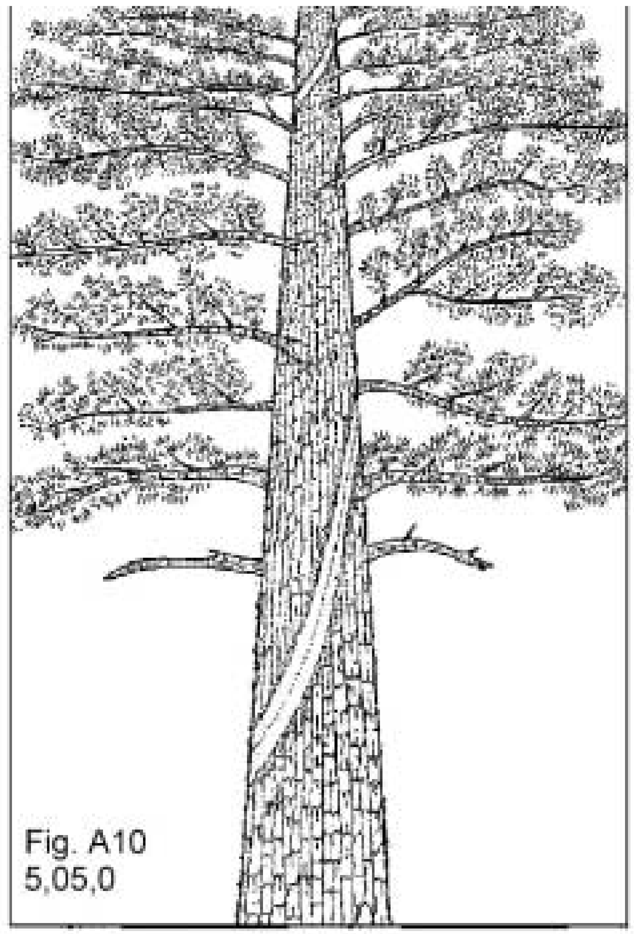


02 - Conks separated by >3'; 2 damages

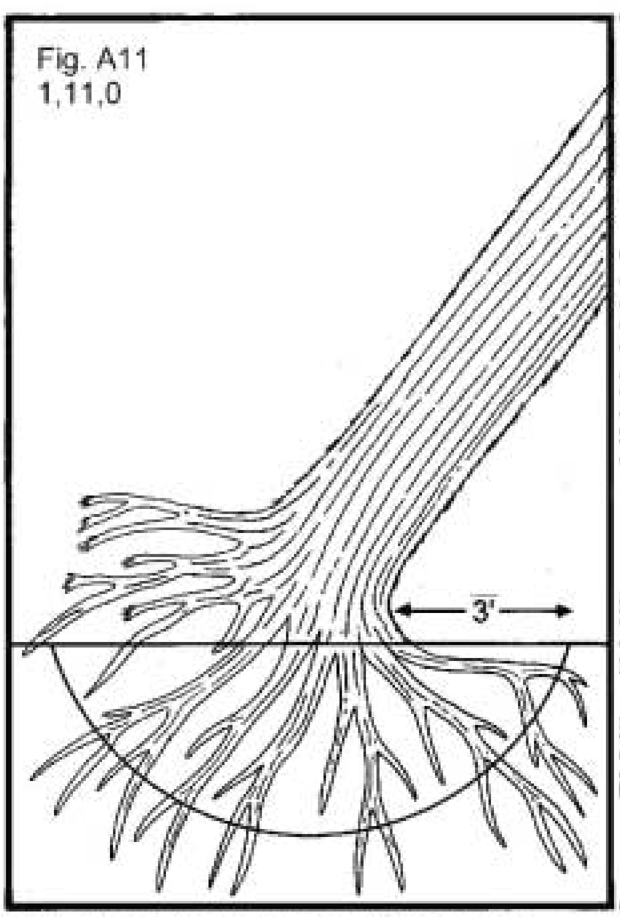
Figure 34. Examples of damage coding.



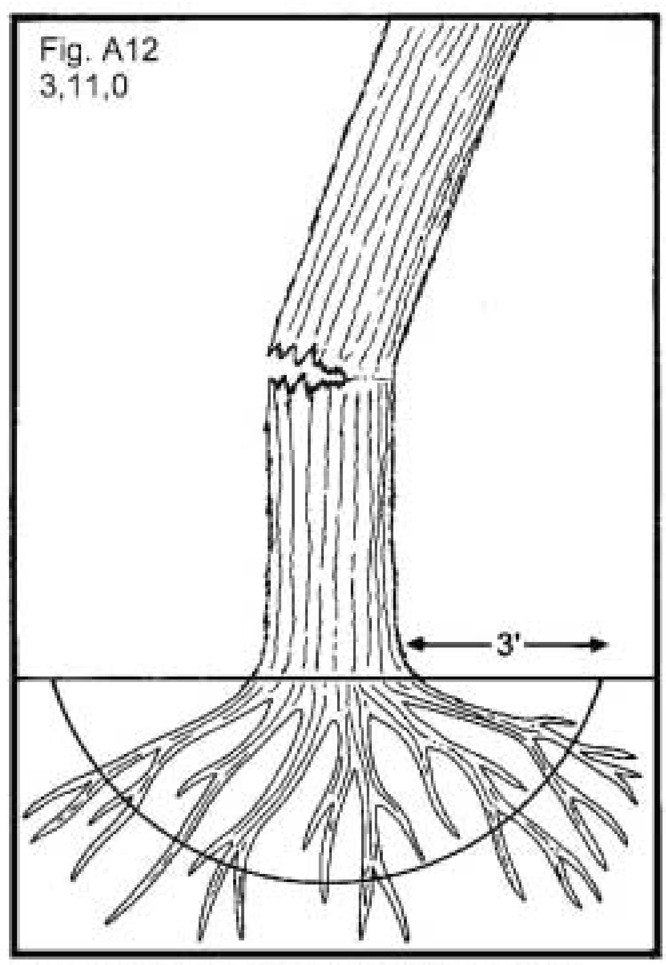
05- Cracks and seams



05 - Lightning strike

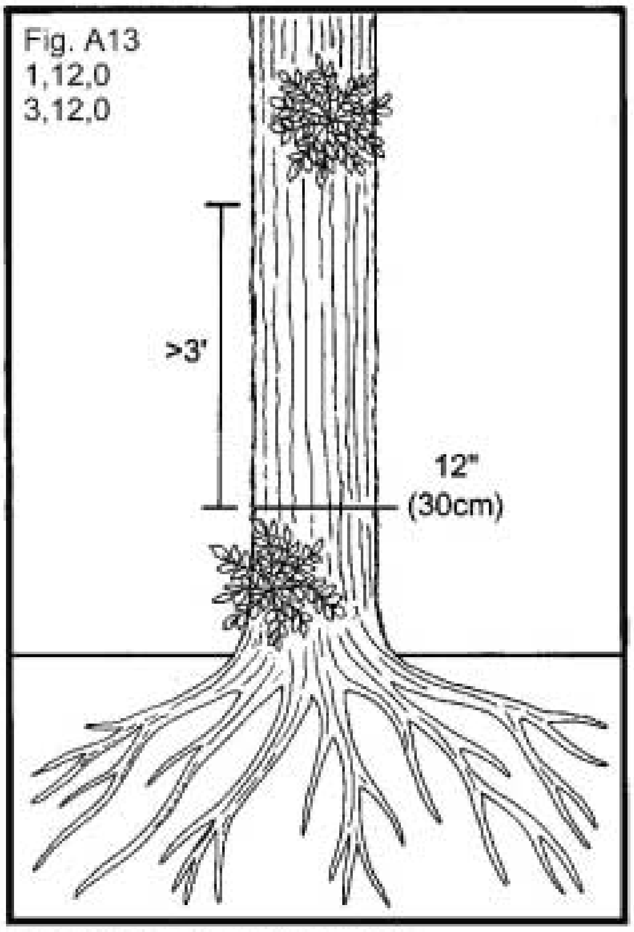


11 - Broken bole or roots <3' from bole, broken roots must be visible

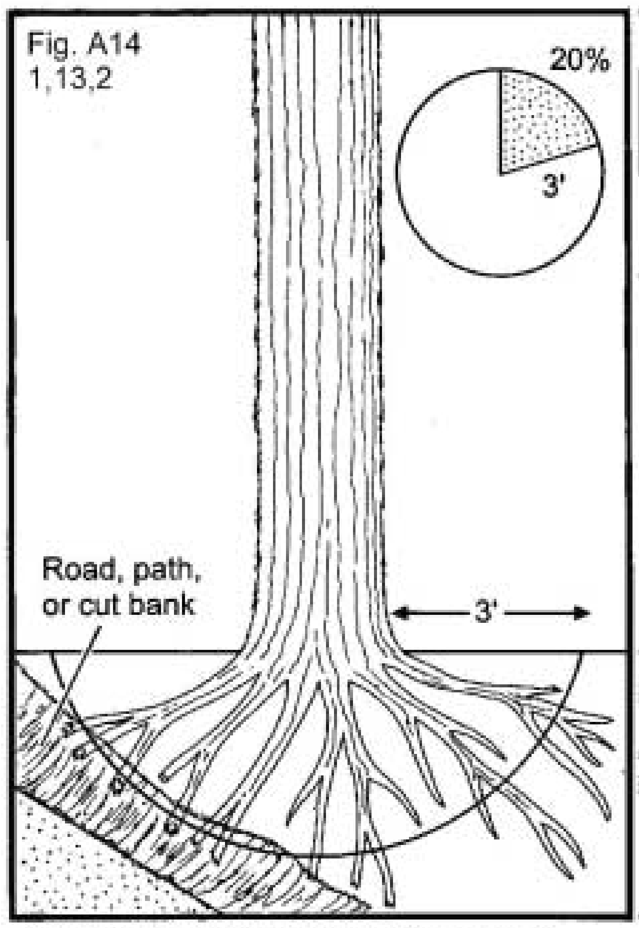


11 - Broken bole or roots <3' from bole

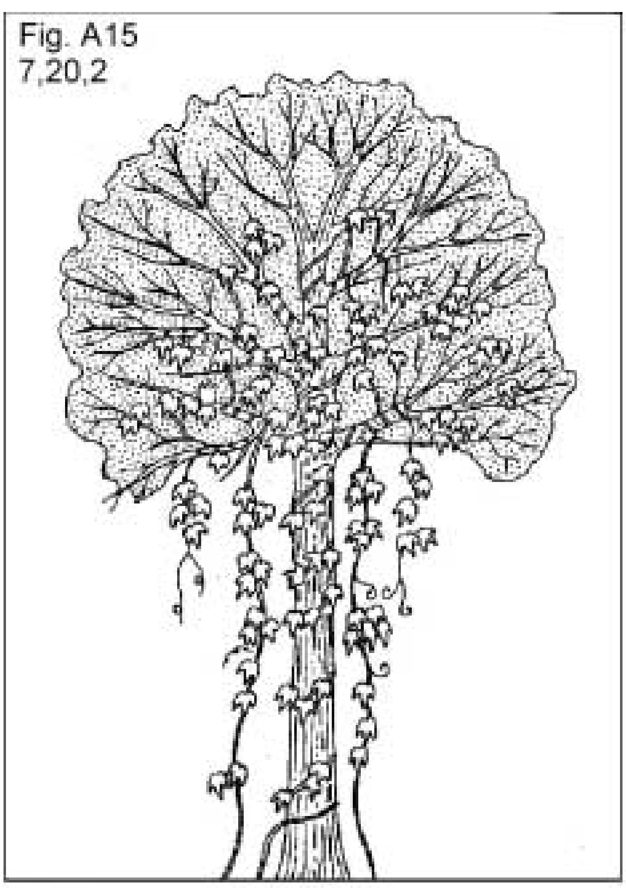
Figure 35. Examples of damage coding.



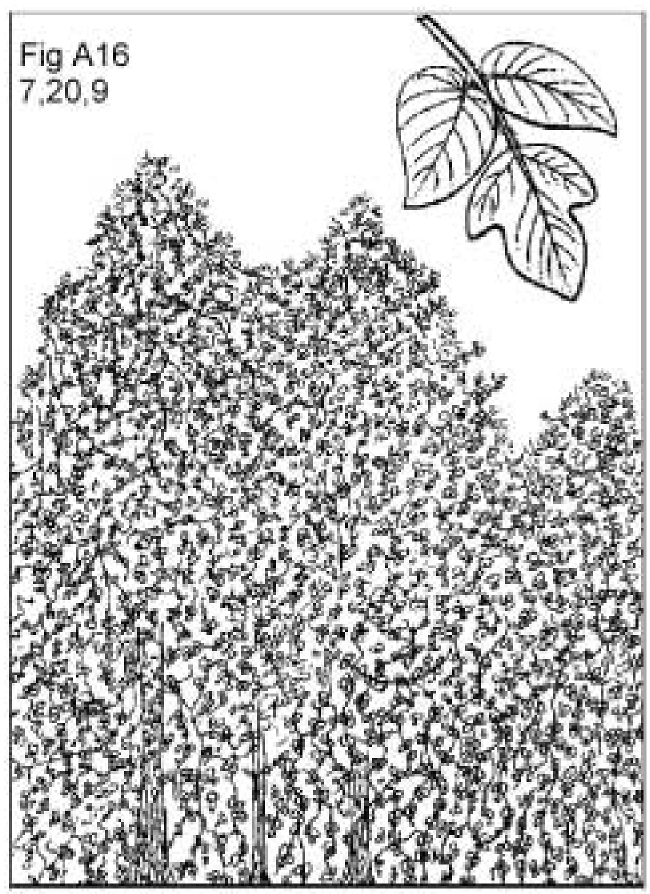
12 - Brooms on roots or bole



13 - Broken or dead roots >3' from bole

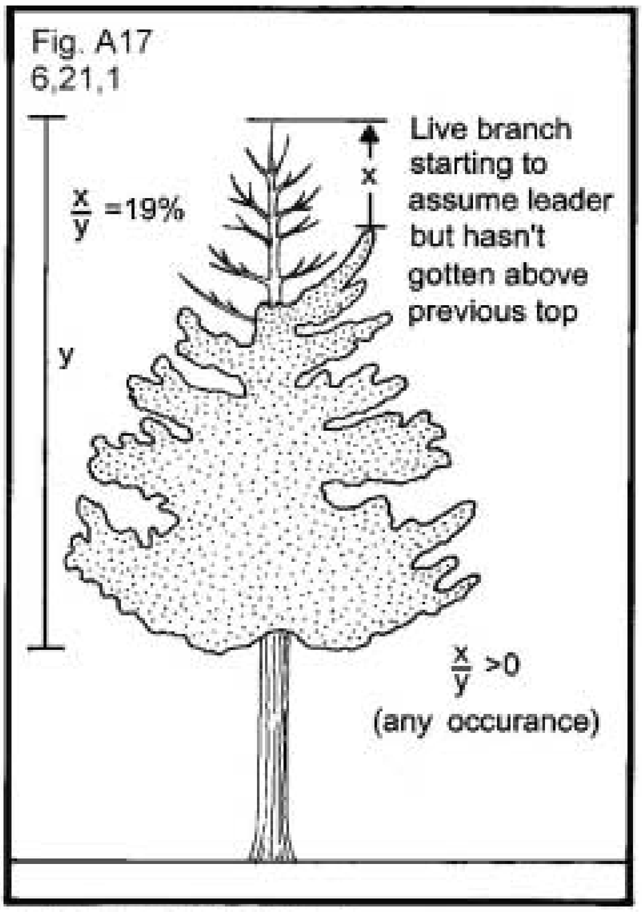


20 - Vines in crown

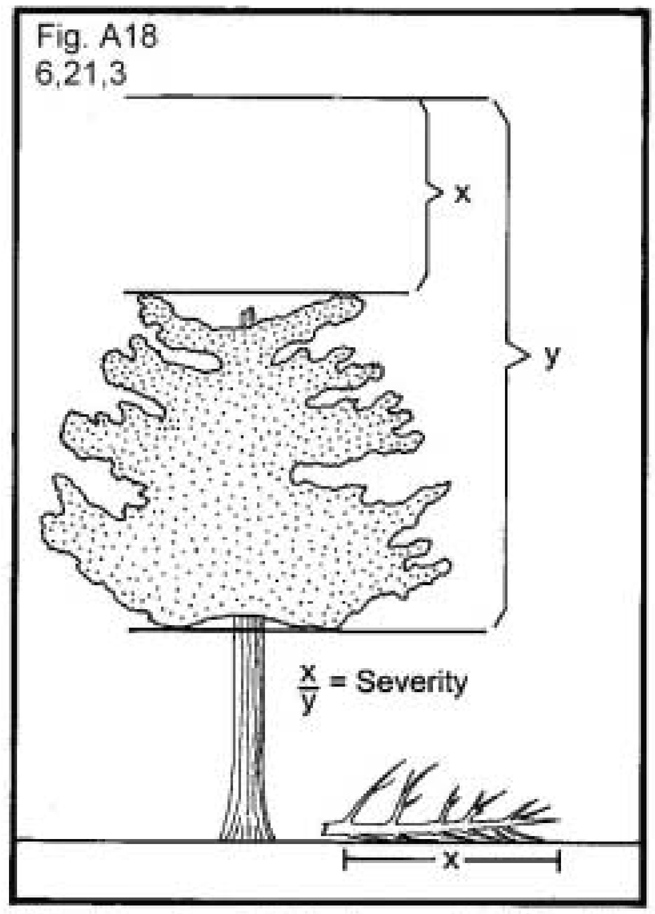


20 - Vines in crown

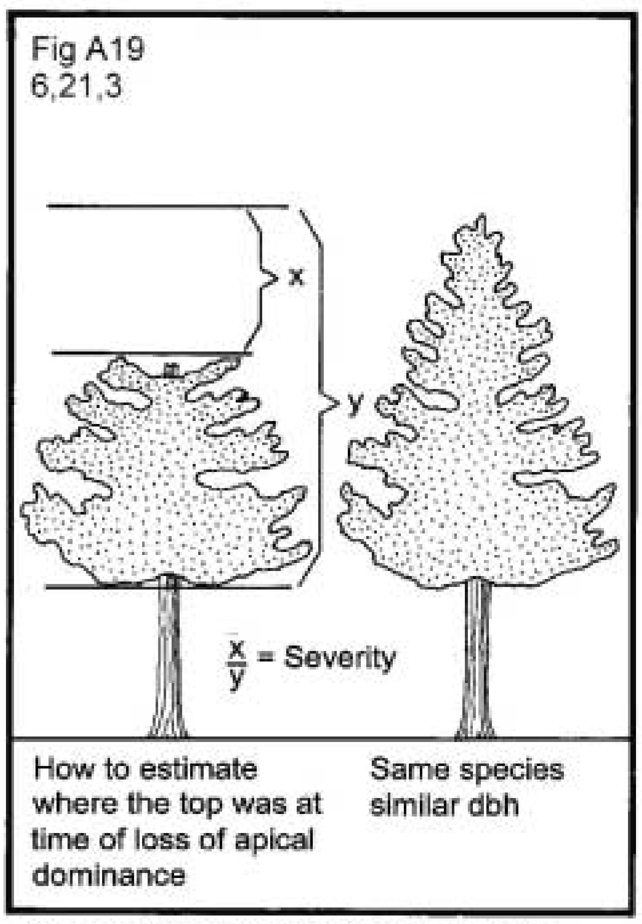
Figure 36. Examples of damage coding.



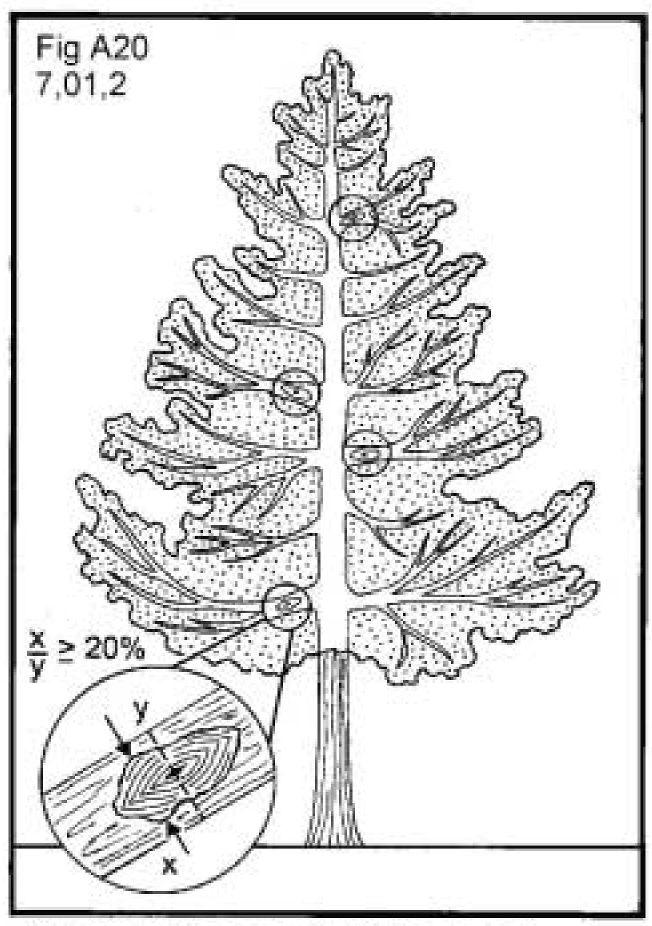
21 - Loss of apical dominance



21 - Loss of apical dominance, look for old top to estimate the top of x and y



21 - Loss of apical dominance, look for same species of similar dbh



01 - Cankers above the threshold on $\geq$ 20% of branches

Figure 37. Examples of damage coding.

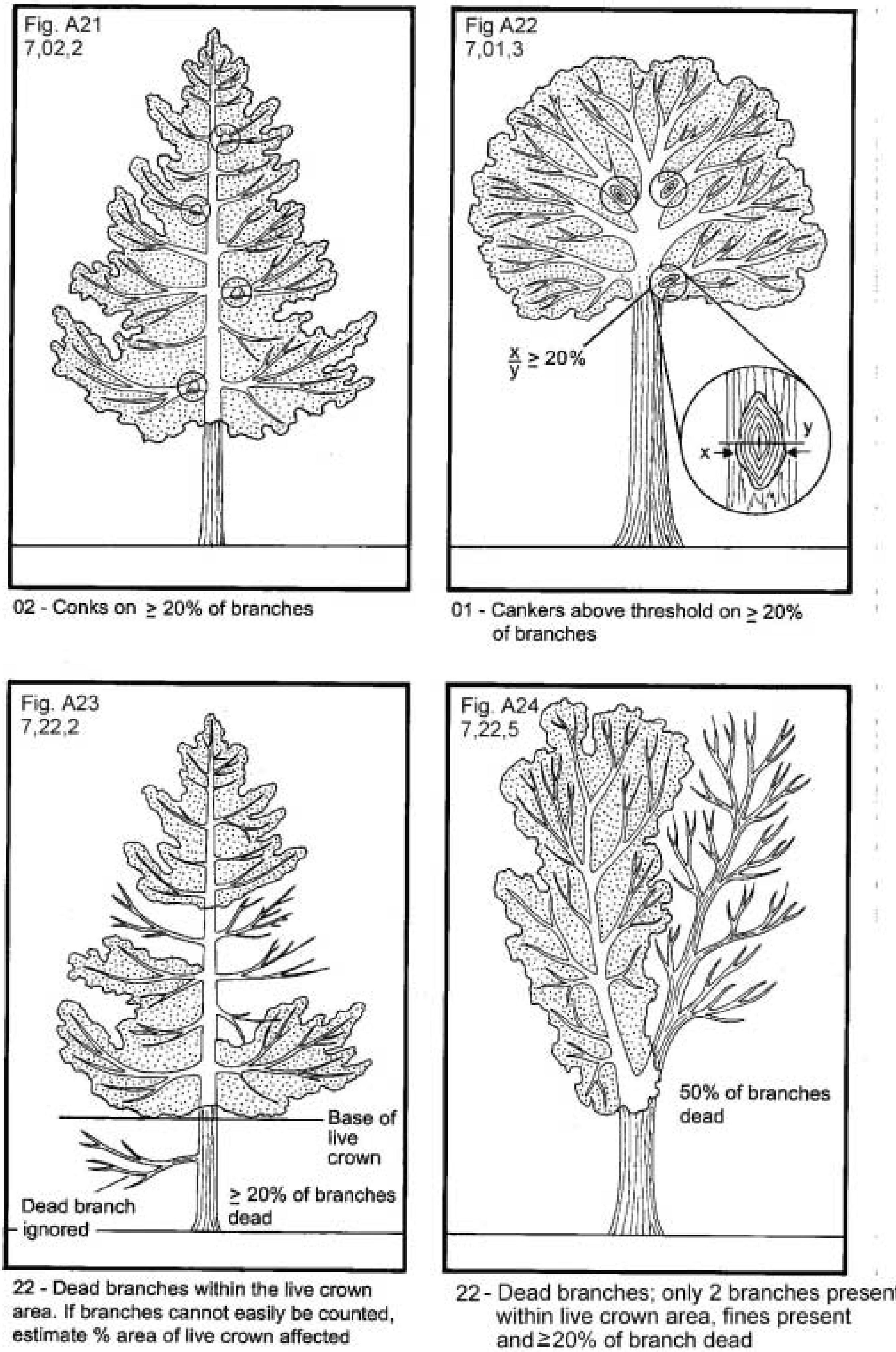
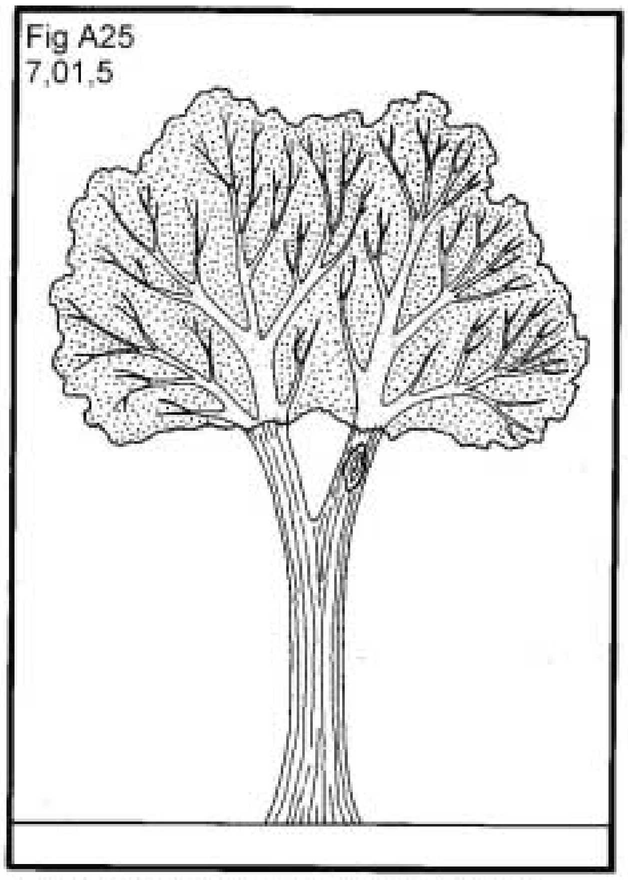
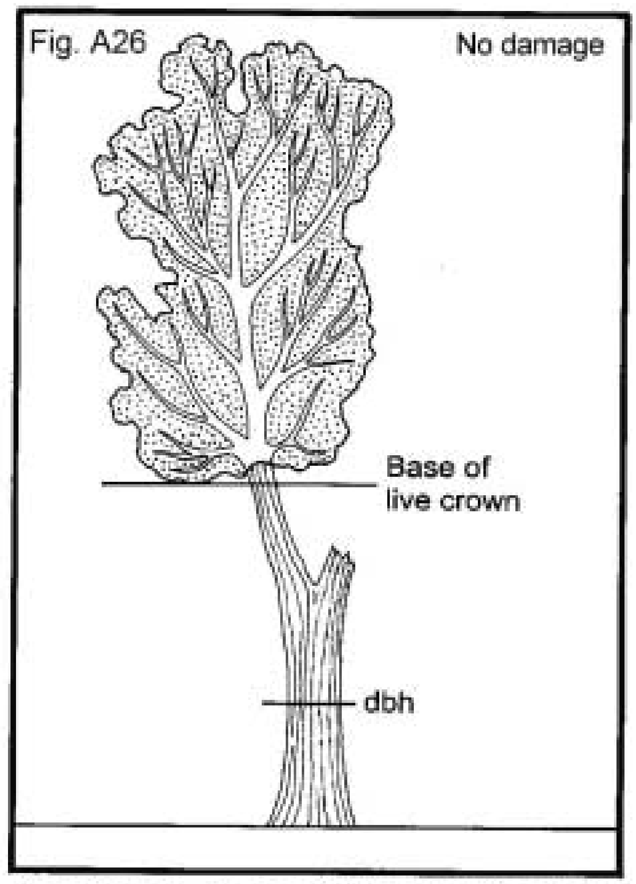


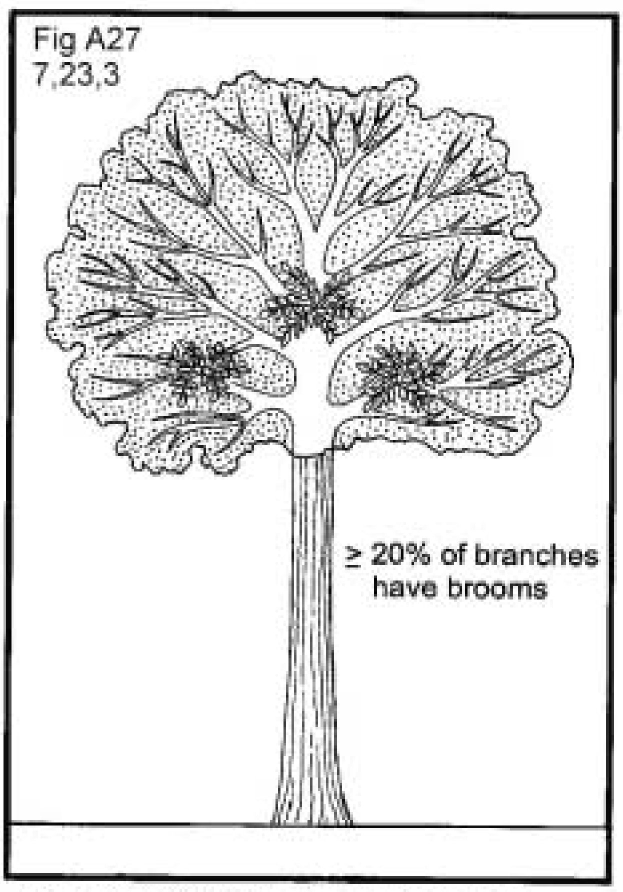
Figure 38. Examples of damage coding.



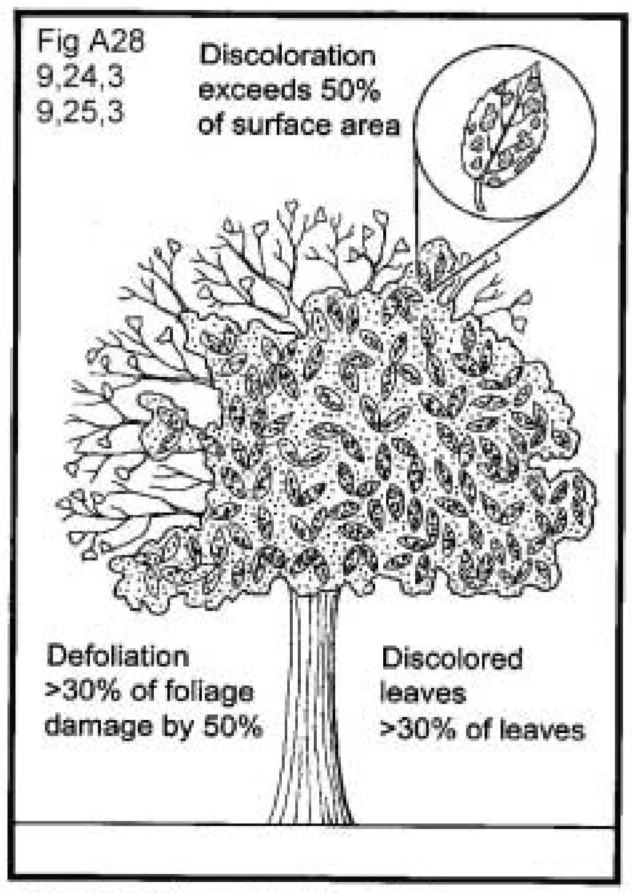
01 - Canker; no crown stem and only 2 branches present



No damage - base of live crown is above old fork, stub is a snag branch



23 - Excessive branching or brooms in crown



24 - Defoliation, 25 - Discoloration

Figure 39. Examples of damage coding.

APPENDIX 4

SITE TREE DATA

SOUTHERN U.S. SITE TREE SELECTION CRITERIA

Ideally, site trees in the eastern U.S. should be between 20-70 years old. If preferred trees cannot be found in this age range, expand the age range to 15-120 years. Reject trees outside the 15-120 year age range, trees that exhibit signs of damage, trees with ring patterns that show signs of suppression, trees less than 5.0 inches DBH, trees with abnormalities at DBH, and trees with rotten cores. A list of preferred site-tree species is provided below. Site trees should be selected in the following order of preference:

1st Choice: representative of the stand, on the list below for your region.

2nd Choice: representative of the stand, on the list below for an adjoining eastern region.

3rd Choice: not representative of the stand, on the list below for your region

4th Choice: not representative of the stand, on the list below for an adjoining eastern region.

Last Choice: any suitable non-woodland tree on the general tree species list.

Note: NE = Northeast, NC = North Central, SO = Southern,
RMRS = Rocky Mountain

Southern Region Species

Code	Common Name	Region
	Softwood Species	
043	Atlantic white-cedar	NE
068	eastern redcedar	NE, NC
107	sand pine	SO
110	shortleaf pine	NE, SO
111	slash pine	SO
121	longleaf pine	SO
128	pond pine	NE, SO
129	eastern white pine	NE, NC, SO
130	Scotch pine	NE, NC
131	loblolly pine	NE, SO
132	Virginia pine	NE, SO
241	northern white cedar	NE, NC
261	eastern hemlock	NE

Code	Common Name	Region
	Hardwood Species	
316	red maple	NE, NC
317	silver maple	NE, NC
318	sugar maple	NE, NC
371	yellow birch	NE, NC
402	bitternut hickory	NE, NC
407	shagbark hickory	NE, NC

462	hackberry	NE
531	American beech	NE
541	white ash	NE, NC
543	black ash	NE, NC
544	green ash	NE, NC
602	black walnut	NE, NC
611	sweetgum	NE, SO
621	yellow-poplar	NE, SO
742	eastern cottonwood	NE, NC, SO
762	black cherry	NE, NC
802	white oak	NE, NC, SO
806	scarlet oak	NE, SO
812	southern red oak	NE, SO
813	cherrybark oak	NE, SO
817	shingle oak	NE, SO
827	water oak	NE, SO
830	pin oak	NE, SO
832	chestnut oak	NE, SO
833	northern red oak	NE, NC, SO
835	post oak	NE, SO
837	black oak	NE, NC, SO
901	black locust	NE
951	American basswood	NE, NC
972	American elm	NE, NC

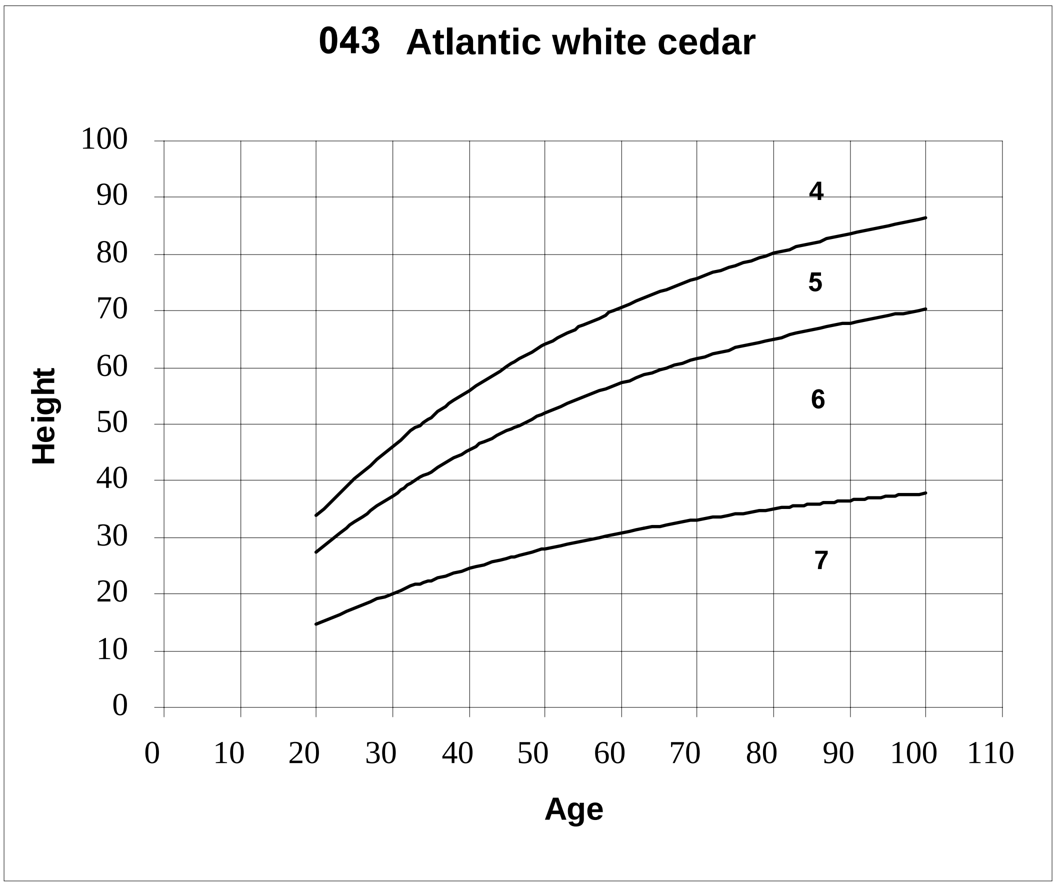
West TX and West OK

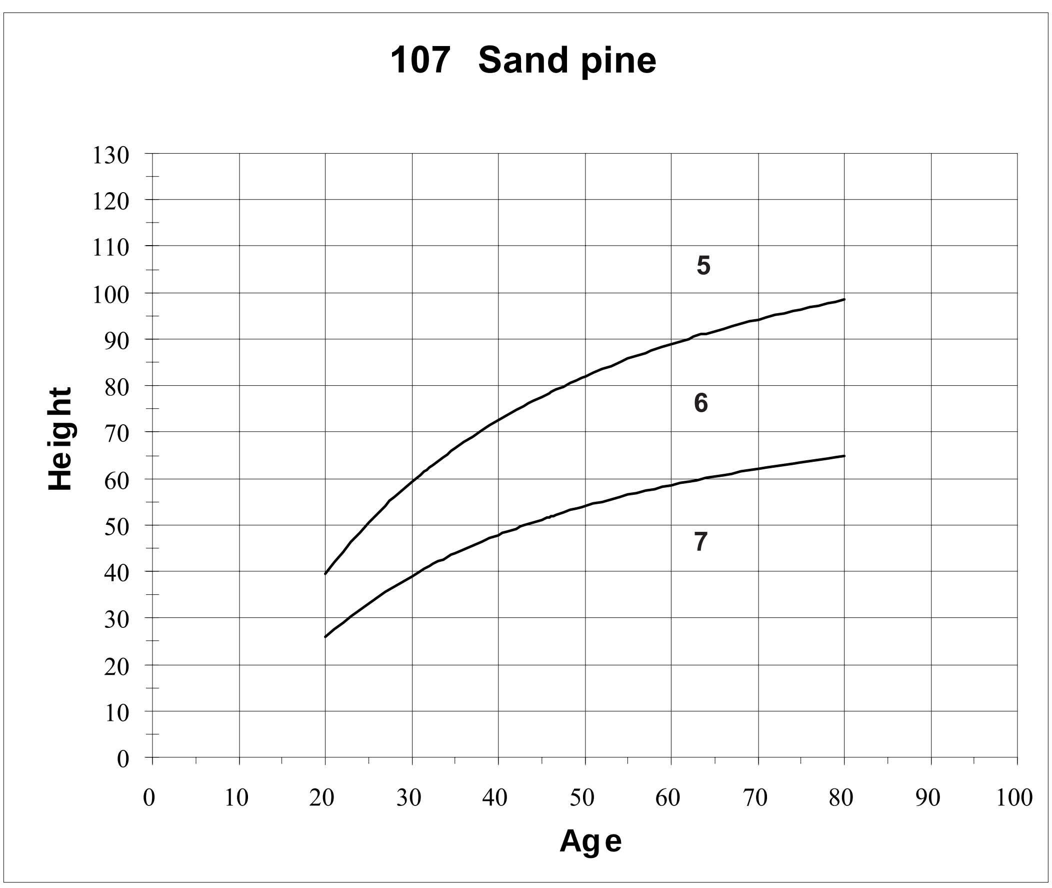
Ideally, site trees in the western U.S. should be between 35-80 years old. If preferred trees cannot be found in this age range, expand the age range to 15-250 years. Reject trees outside the 15-250 year age range, trees that exhibit signs of damage, trees with ring patterns that show signs of suppression, trees less than 5.0 inches DBH, trees with abnormalities at DBH, trees with rotten cores, and woodland species. A list of preferred site-tree species are provided below.

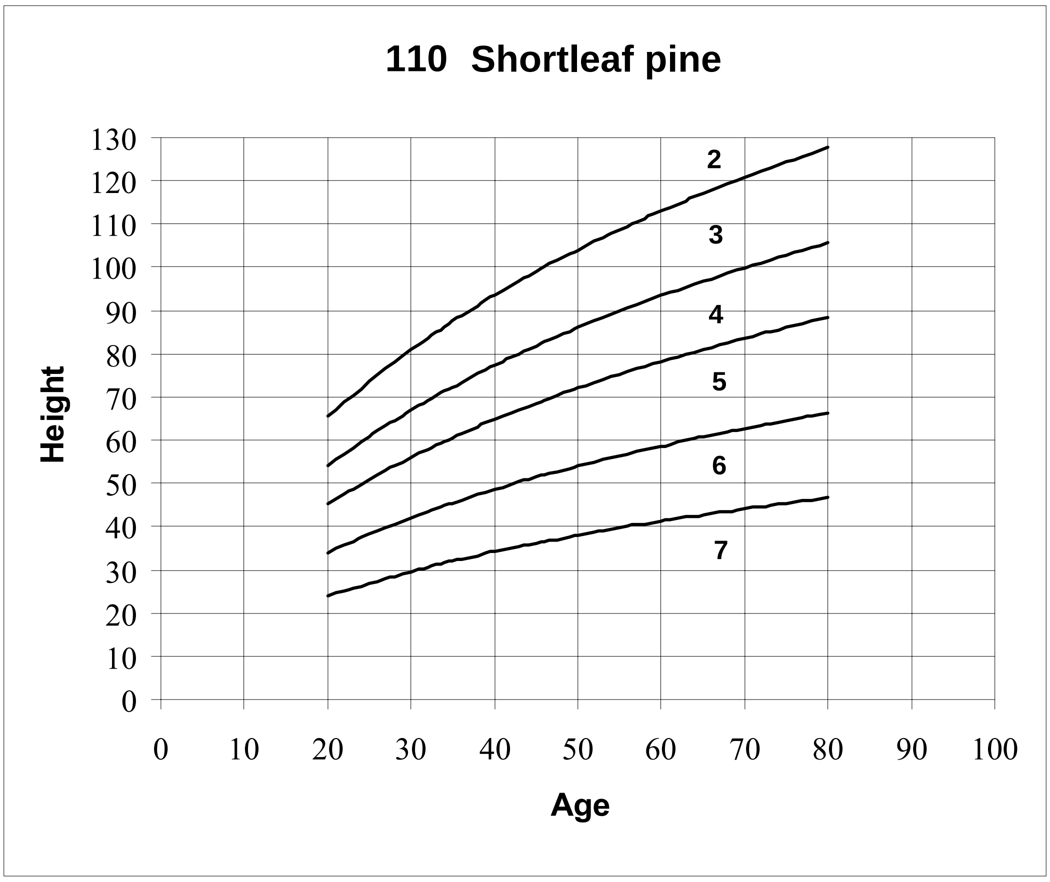
Code	**Common Name**	**Region**
	--------------------------------Softwood Species--------------------------------	
122	Ponderosa pine	RMRS, PNW

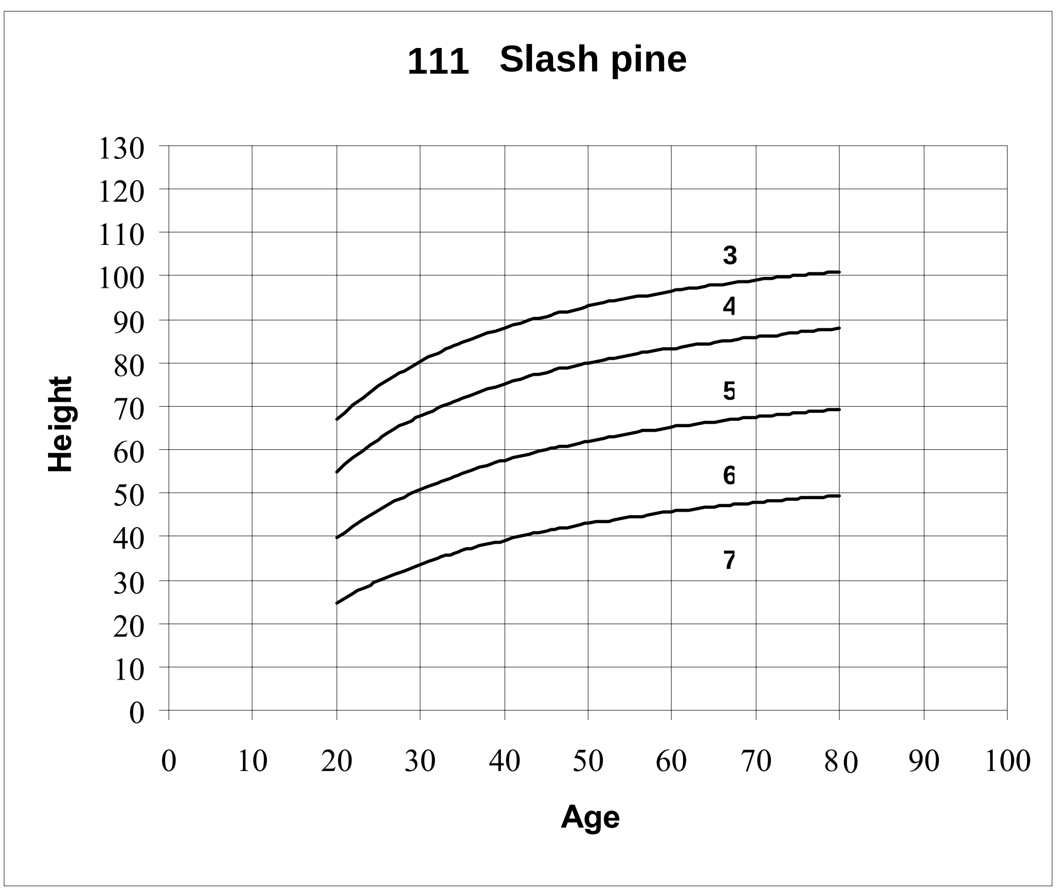
Code	**Common Name**	**Region**
	--------------------------------Hardwood Species--------------------------------	
748	Rio Grande cottonwood, Freemont poplar	RMRS
749	Narrowleaf cottonwood	RMRS

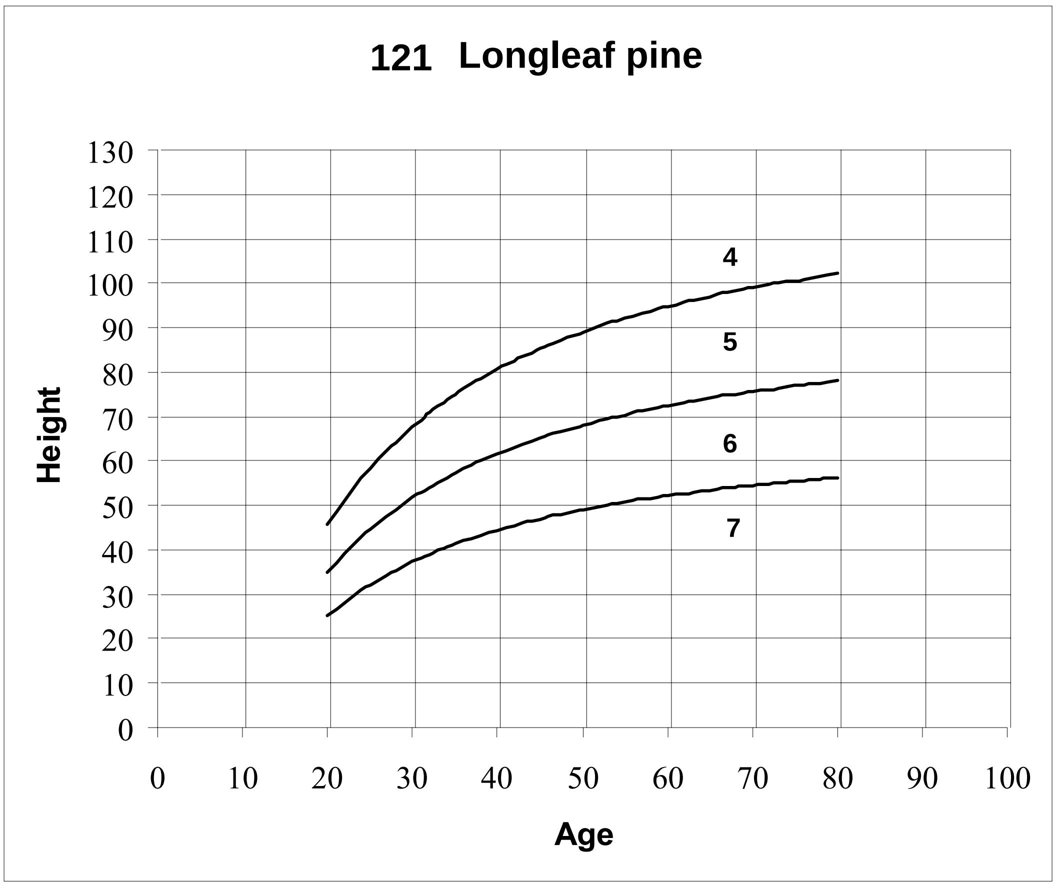
SITE CLASS CURVES

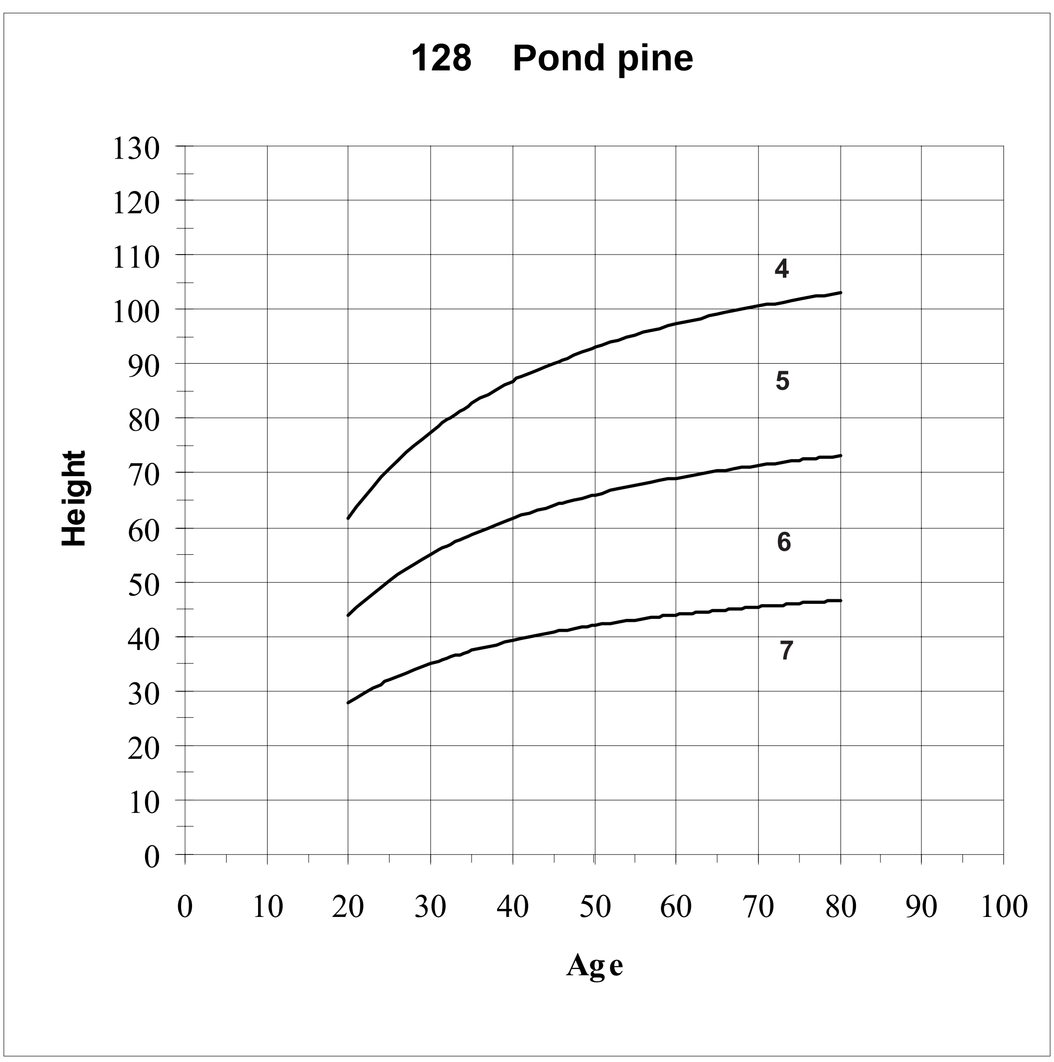


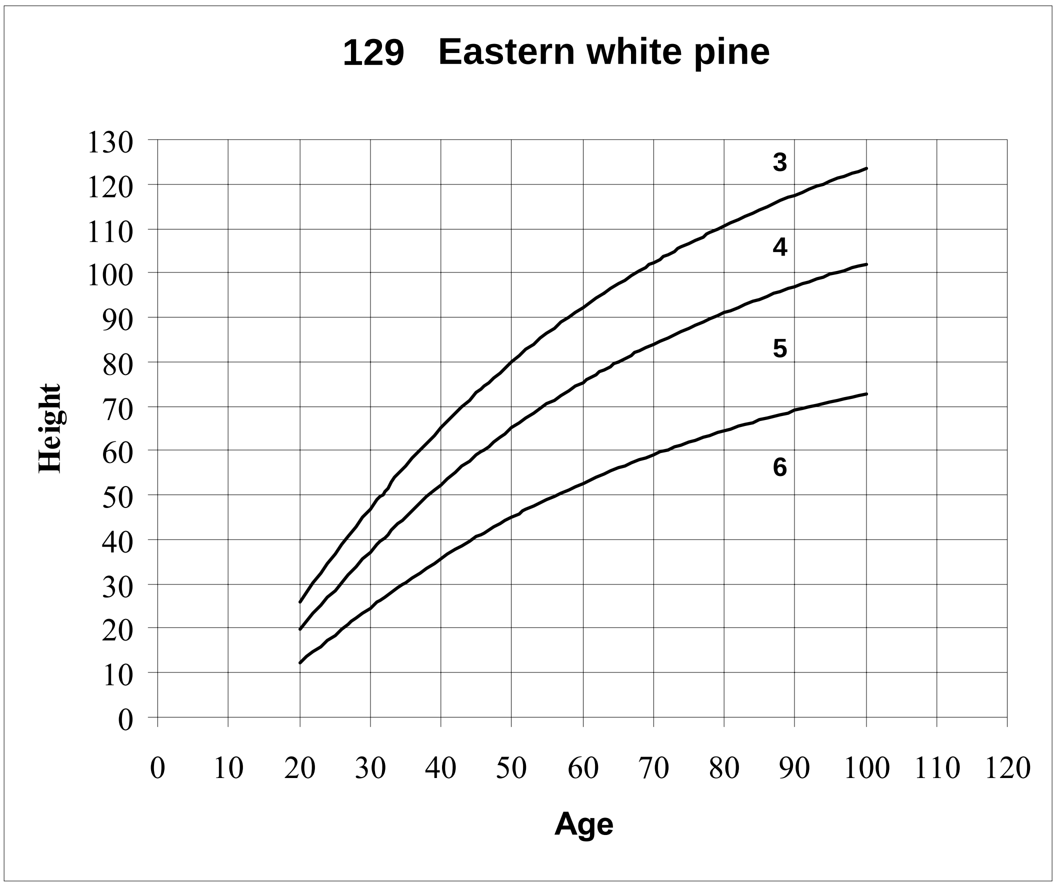


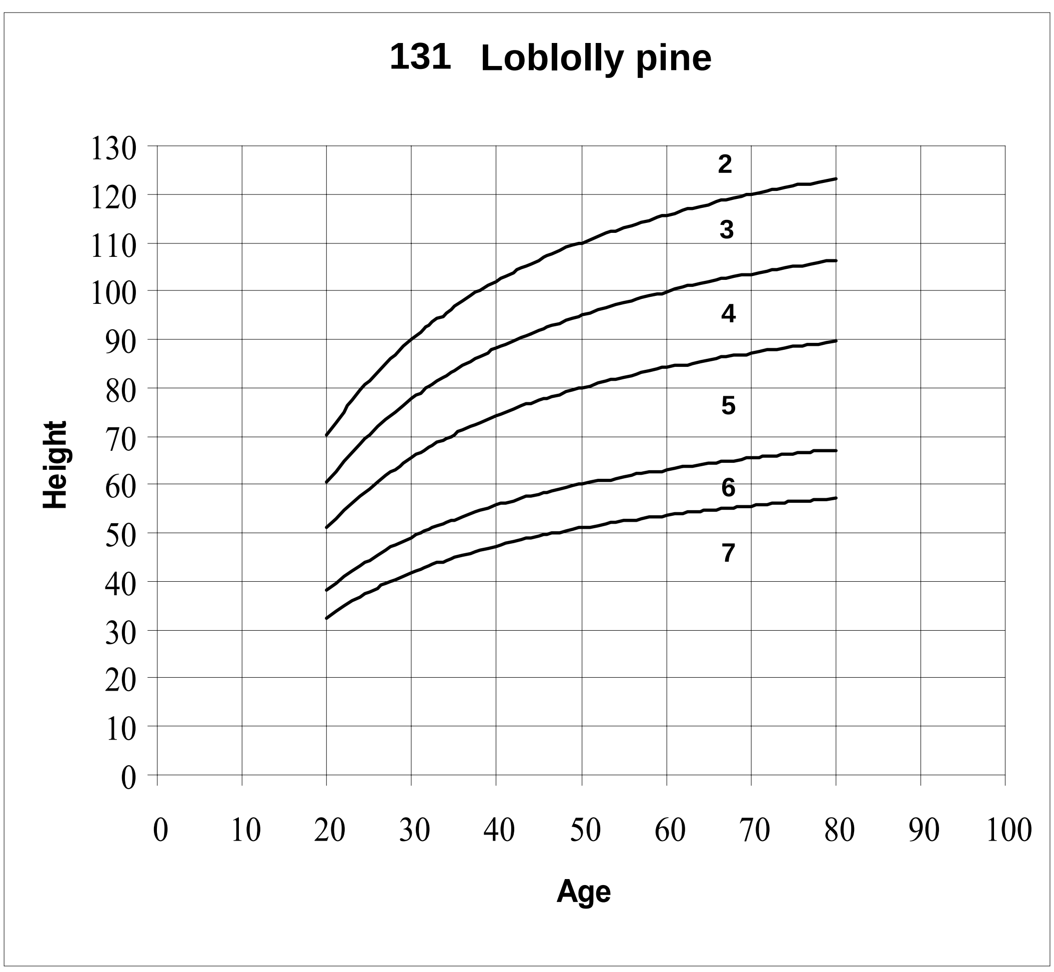

110 Shortleaf pine
Height
Age
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100 110 120 130
2
3
4
5
6
7

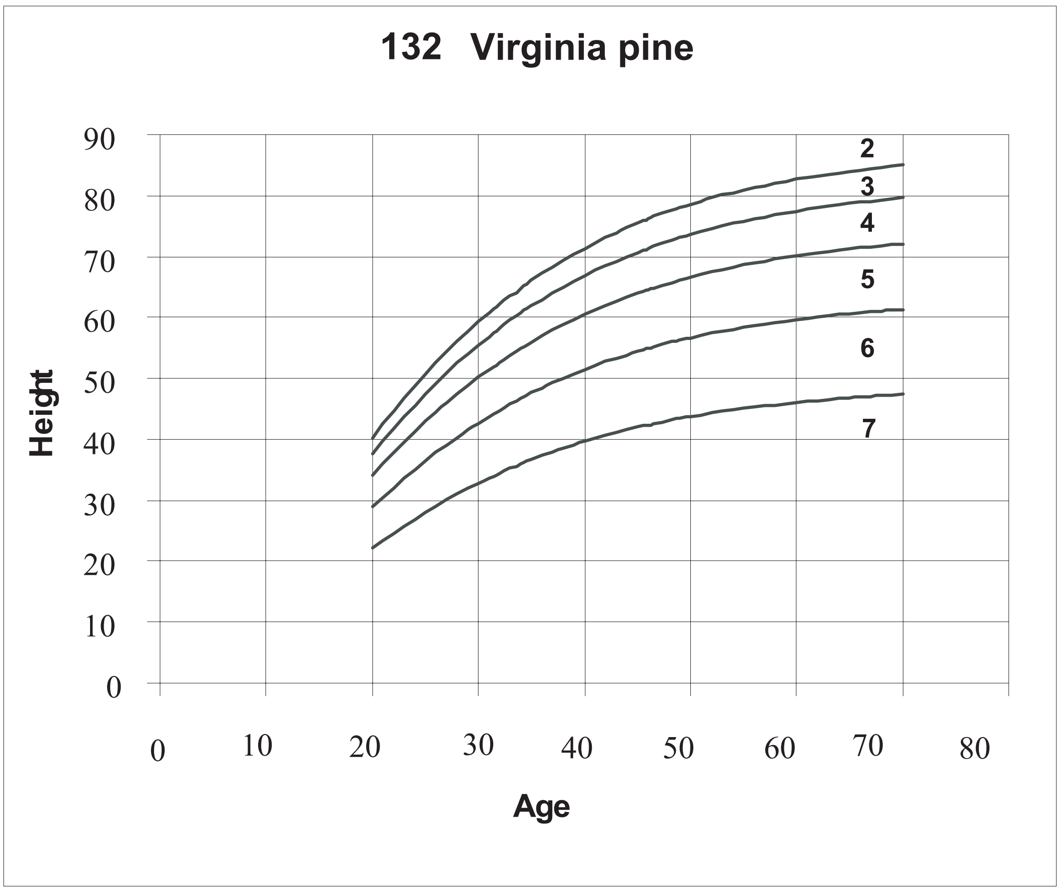

111 Slash pine
Height
Age
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100 110 120 130
3
4
5
6
7

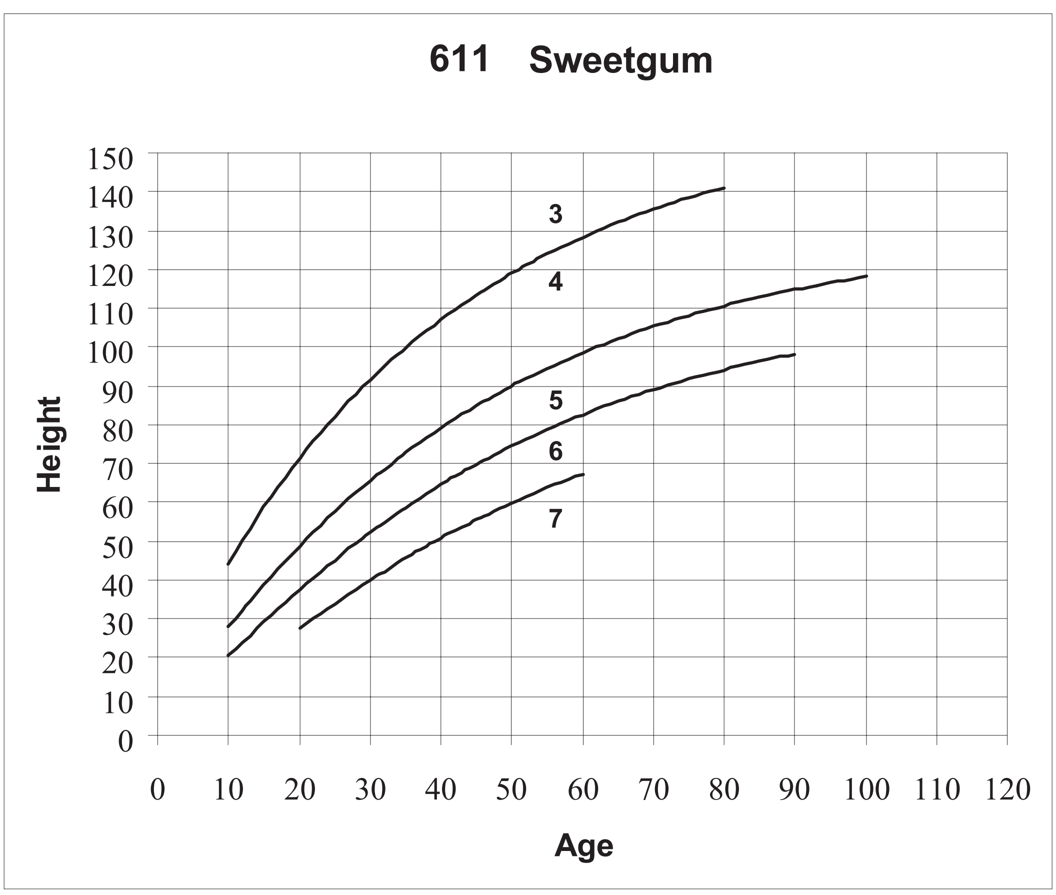

121 Longleaf pine
Height
Age
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
4
5
6
7

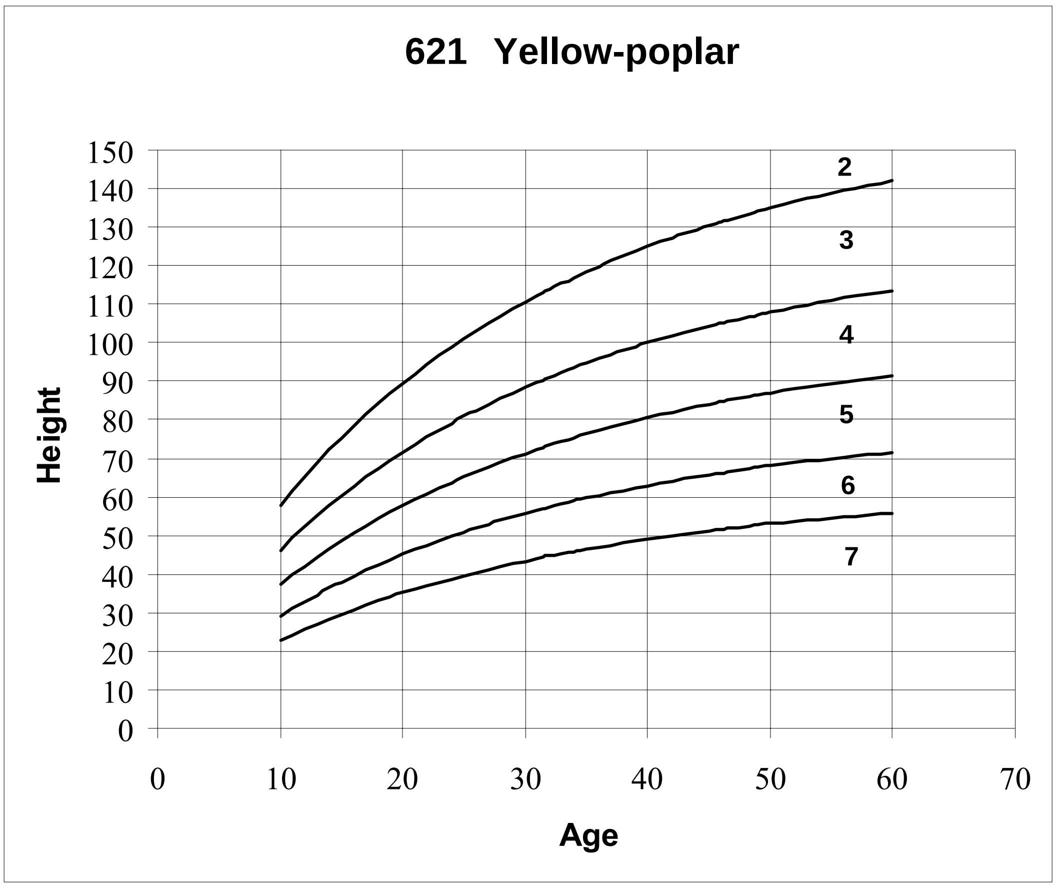

128 Pond pine
Height
Age
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
4
5
6
7


129 Eastern white pine
Height
Age
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100 110 120
3
4
5
6

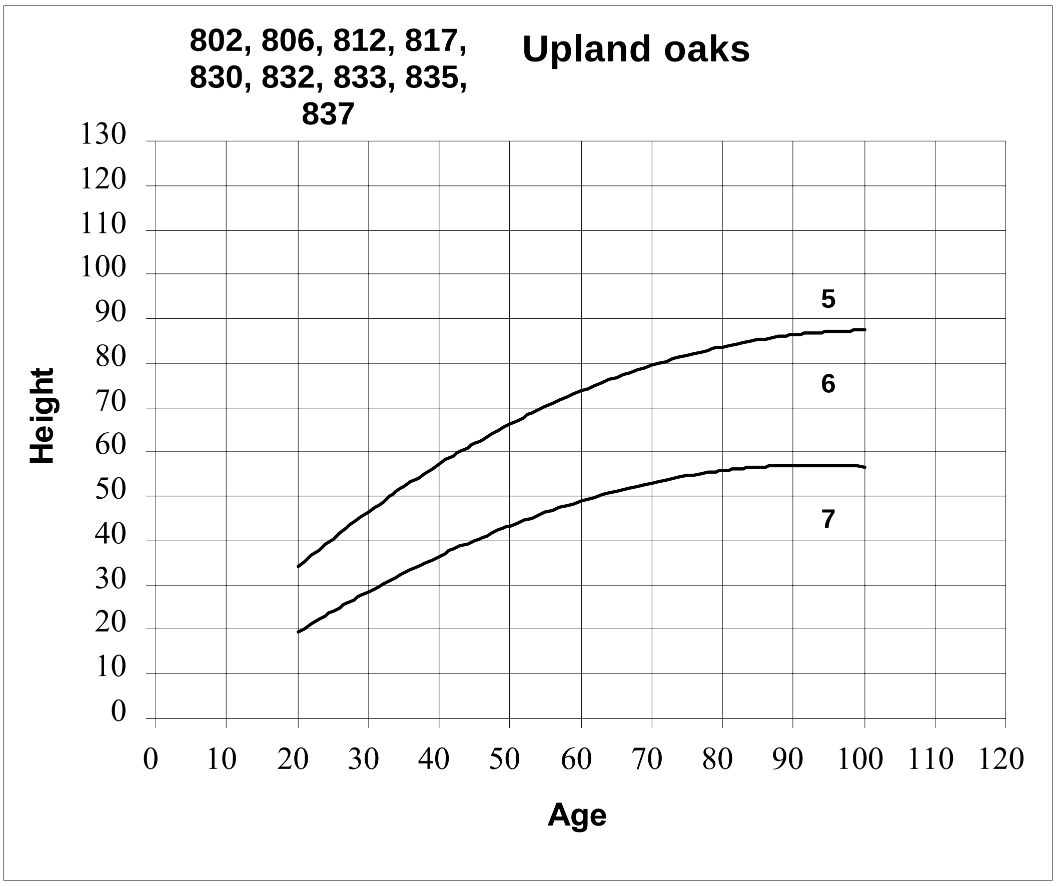

131 Loblolly pine
Height
Age
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
2
3
4
5
6
7

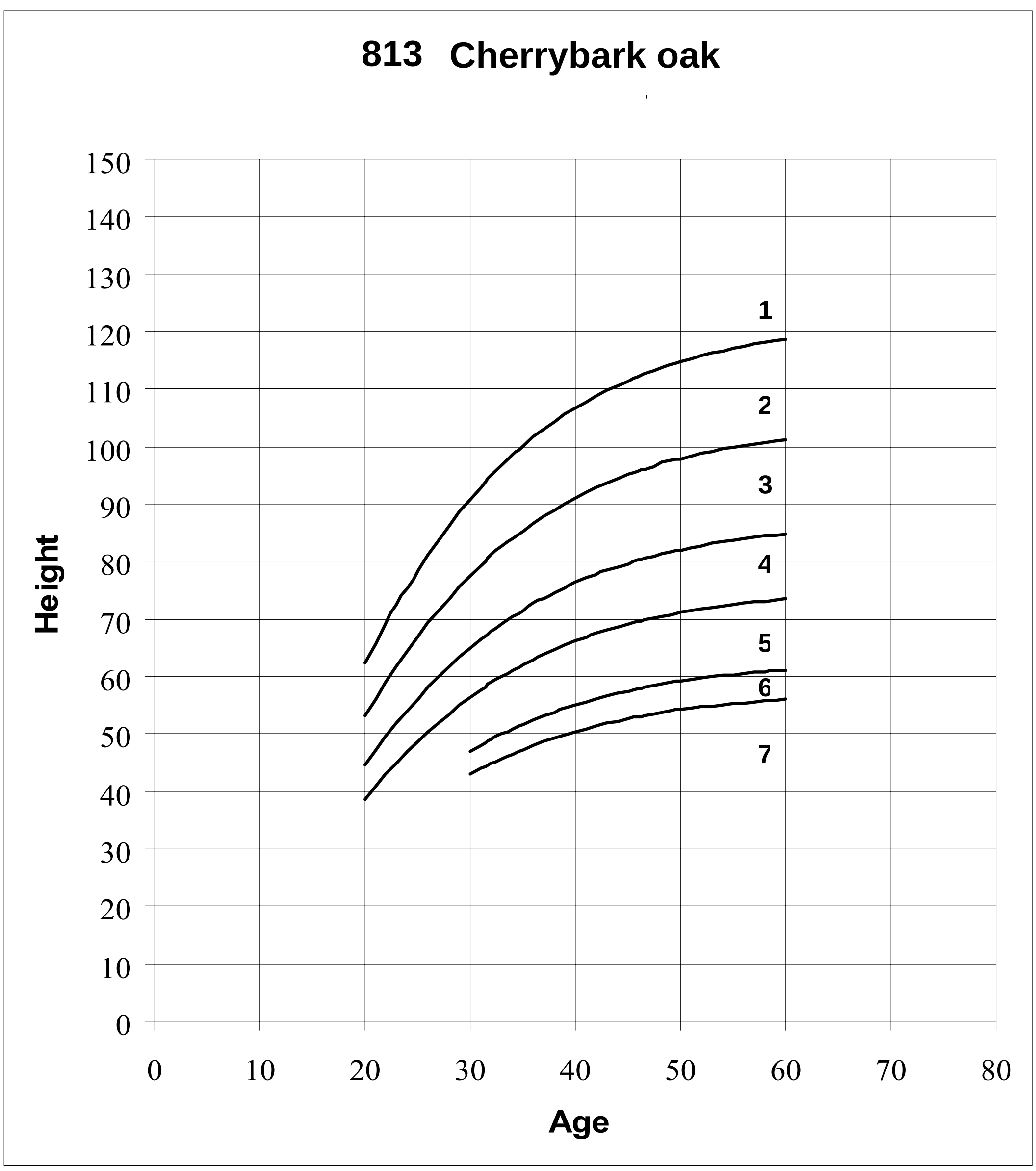

132 Virginia pine
Height
Age
0
10
20
30
40
50
60
70
80
90
2
3
4
5
6
7

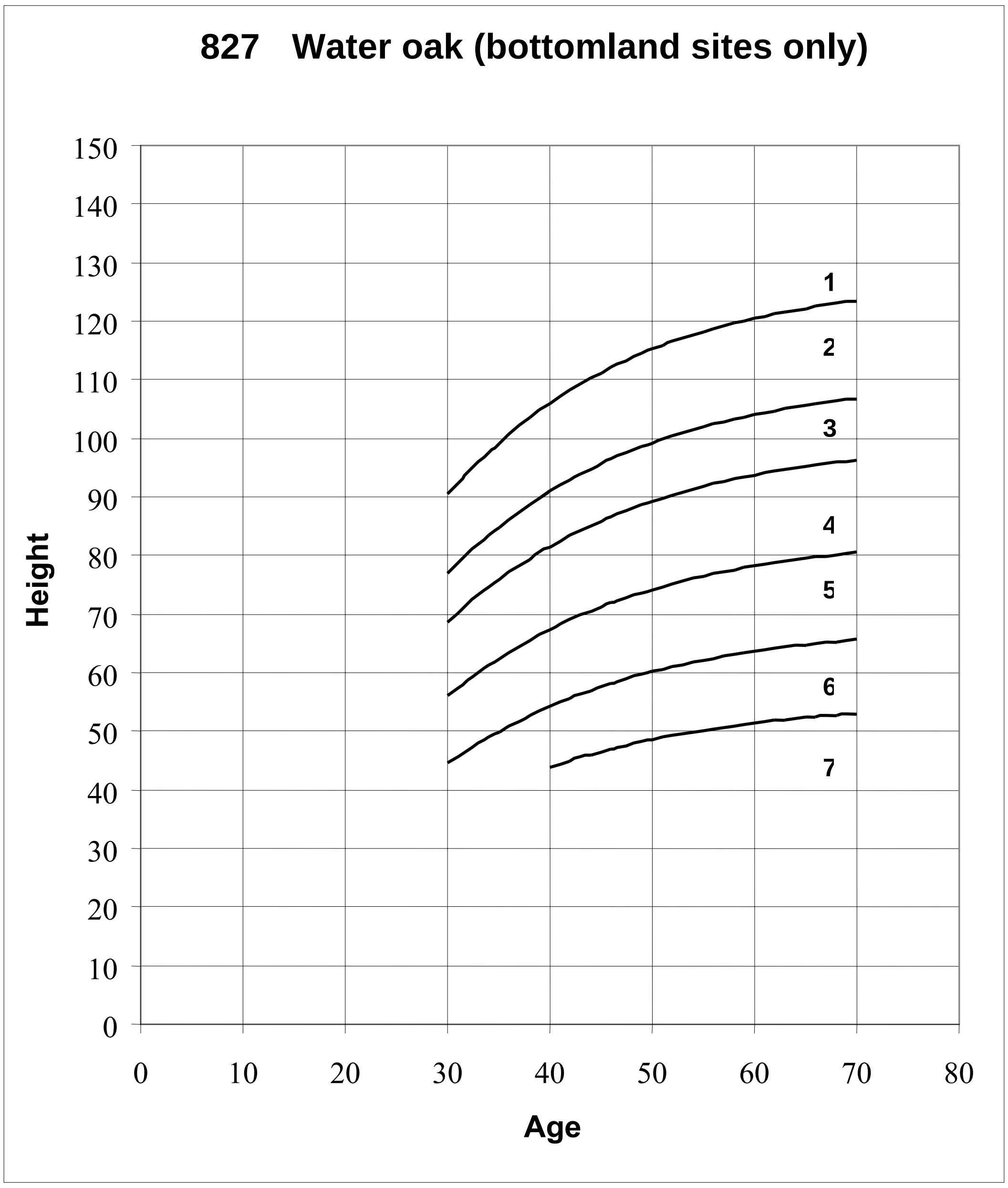

611 Sweetgum
Height
Age
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
3
4
5
6
7


621 Yellow-poplar
Height
Age
2
3
4
5
6
7
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70


742 Cottonwood
Height
Age
1
2
3
4
5
6
110
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60


802, 806, 812, 817, 830, 832, 833, 835, 837
Upland oaks
Height
Age
5
6
7
0 10 20 30 40 50 60 70 80 90 100 110 120 130
0 10 20 30 40 50 60 70 80 90 100 110 120


813 Cherrybark oak
Height
Age
1
2
3
4
5
6
7
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
0 10 20 30 40 50 60 70 80


827 Water oak (bottomland sites only)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
Height
Age
1
2
3
4
5
6
7

APPENDIX 6

TOLERANCE / MQO / VALUE / UNITS / FACTOR TABLE

Core optional variables are in italics. n/a is not applicable. Regional items are shaded. All item numbers follow regional format. All Factor values are regional.

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
Plot Level Data						
1010	STATE	No errors	at least 99% of the time	Appendix 1	n/a	5
1020	COUNTY	No errors	at least 99% of the time	Appendix 1	n/a	5
1030	PLOT NUMBER	No errors	at least 99% of the time	0001 to 9999	n/a	5
1200	P3 HEXAGON NUMBER	No errors	at least 99% of the time		n/a	5
1210	P3 PLOT NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
1040	SAMPLE KIND	No errors	at least 99% of the time	1 to 3, 9	n/a	5
1050	MANUAL VERSION	No errors	at least 99% of the time	1.5	n/a	1
1060	CURRENT DATE	No errors	at least 99% of the time		yyyy/ mm/dd	1
R101	PAST DATE	No errors	At leat 99% of the time		yyyy/ mm/dd	1
1160	QA STATUS	No errors	at least 99% of the time	1 to 7	n/a	1
1170	CREW TYPE	No errors	at least 99% of the time	1, 2	n/a	1
R102	CRUISER #	No errors	At least 99% of the time	001 to 999	n/a	1
R103	# OF ACCESSIBLE FORESTLAND CONDITIONS	No errors	At least 99% of the time	1 to 9	n/a	1
R104	# OF TREE ENTRIES	No errors	At least 99% of the time	000 to 999	n/a	1
R109	PRISM POINT REMEASURED/ SUBPLOT CENTERS REVERTED	No errors	At least 99% of the time	0 to 5	n/a	1
1080	TRAILS OR ROADS	No errors	at least 90% of the time	0 to 5	n/a	1
1100	ROAD ACCESS	No errors	at least 90% of the time	0 to 4, 9	n/a	1
1110	PUBLIC USE RESTRICT-IONS	No errors	at least 90% of the time	0 to 3, 9	n/a	1
1120	RECREATION USE 1	No errors	at least 90% of the time	0 to 7, 9	n/a	1
1130	RECREATION USE 2	No errors	at least 90% of the time	0 to 7, 9	n/a	1
1140	RECREATION USE 3	No errors	at least 90% of the time	0 to 7, 9	n/a	1
R105	HUMAN DEBRIS	No errors	At least 80% of the time	0 to 3	n/a	1
1150	WATER ON PLOT	No errors	at least 90% of the time	0 to 5, 9	n/a	1
1090	HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	at least 90% of the time	1 to 9	n/a	1
R106	HORIZONTAL DISTANCE TO URBAN	No errors	At least 90% of the time	1 to 9	n/a	1
R107	HORIZONTAL DISTANCE TO AGRICULTURE	No errors	At least 90% of the time	1 to 9	n/a	1
R108	SIZE OF CONTIGUOUS FOREST	No errors	At least 90% of the time	0 to 7	n/a	1
1803	GPS UNIT	No errors	at least 99% of the time	0 to 4	n/a	1
1804	GPS SERIAL NUMBER	No errors	at least 99% of the time	000001 to 999999	n/a	1
1806	LATITUDE	+/- 140’	at least 99% of the time	See App.1	D/M/S	3
1807	LONGITUDE	+/- 140’	at least 99% of the time	See App.1	D/M/S	3

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
1814	GPS ELEVATION	No errors	at least 99% of the time	-00100 to 20000	FEET	1
1815	GPS ERROR	No errors	at least 99% of the time	0 to 70 if possible 71 to 999 if an error < 70 cannot be obtained	feet	1
1816	NUMBER OF AVG.READINGS	No errors	at least 99% of the time	1 to 999	n/a	1
1812	AZIMUTH TO PLOT CENTER	+/- 3 degrees	at least 99% of the time	000 at plot center 001 to 360 not at plot center	degrees	1
1813	DISTANCE TO PLOT CENTER	+/- 6 ft	at least 99% of the time	000 at plot center 001 to 200 if a Laser range finder not used 001 to 999 if a Laser range finder is used	feet	1
1190	PLOT-LEVEL NOTES	When applicable	When applicable	English, alpha-numeric	n/a	1 to 5
Condition Level Data						
2201	CONDITION CLASS NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
R201	SIMILAR IDENTIFIED CONDITION	No errors	At least 99% of the time	0 to 9	n/a	5
2425	PRESENT LAND USE	No errors	At least 99% of the time	01-03;10-16; 20; 30-33; 40-43; 90-94	n/a	5
2202	PRESENT CONDITION STATUS	No errors	at least 99% of the time	1 to 7, 9	n/a	5
R203	NEW PAST LAND USE	No errors	At least 99% of the time	01-03;10-16; 20; 30-33; 40-43; 90-94	n/a	5
R202	NEW PAST CONDITION STATUS	No errors	At least 99% of the time	1 to 7, 9	n/a	5
R219	OLD LAND USE	No errors	At leasrt 99% of the time	01-03;10-16; 20; 30-33; 40-43; 90-94	n/a	5
2426	NONFOREST YEAR	+/- 1 year for 5-year measure. cycles +/- 2 years for > 5-year measure. cycles	at least 70% of the time	1996 or higher	year	1
2401	RESERVED STATUS	No errors	at least 99% of the time	0, 1	n/a	3
2407	OWNER CLASS	No errors	at least 99% of the time	11-13; 21-25; 31-33; 41-45	class	2
2402	OWNER GROUP	No errors	at least 99% of the time	10, 20, 30, 40	n/a	3
2408	PRIVATE OWNER INDUSTRIAL STATUS	No errors	at least 99% of the time	0, 1	n/a	1
R205	TRACT SIZE (TOTAL ACRES)	No errors	At least 99% of the time	00001 to 99999	n/a	1
R206	PERCENT FOREST	No errors	At least 99% of the time	001 to 100	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
2403	PRESENT FOREST TYPE	No errors	at least 99% of the time in group at least 95% of the time in type	Appendix 2	n/a	5
R207	NEW PAST FOREST TYPE	No errors	at least 99% of the time in group at least 95% of the time in type	Appendix 2	n/a	3
2404	STAND SIZE CLASS	No errors	at least 99% of the time	0 to 6	class	5
2405	PRESENT REGENERATION STATUS	No errors	at least 99% of the time	0, 1	n/a	5
R209	PAST REGENERATION STATUS	No errors	at least 99% of the time	0, 1	n/a	3
2409	ARTIFICIAL REGENERATION SPECIES	No errors	at least 99% of the time	Appendix 4	n/a	1
2406	TREE DENSITY	No errors	at least 99% of the time	1 to 3	n/a	1
2410	STAND AGE	+/- 10%	at least 95% of the time	000 to 997, 998, 999	year	5
R211	STAND STRUCTURE	No errors	at least 99% of the time	1 to 4	n/a	1
2411 413 2415	DIST 1, 2, 3	No errors	at least 99% of the time	00; 10; 20; 30-32;40-46; 50-54; 60; 70; 80	n/a	5/each
2412 2414 2416	DIST YEAR 1, 2, 3	+/- 1 year for 5-year measure. cycles +/ 2years for > 5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuousl y over time	year	1/each
2417 2419 2421	TREATMENT 1, 2, 3	No errors	at least 99% of the time	00, 10, 20, 30, 40, 50	n/a	5/each
2418 2420 2422	TREATMENT YEAR 1, 2, 3	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	at least 99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year	1/each
2423	PHYSIO-GRAPHIC CLASS	No errors	at least 80% of the time	xeric: 11, 12, 13, 19 mesic: 21, 22, 23, 24, 25, 29 hydric: 31, 32, 33, 34, 35, 39	n/a	3
R212	OPERABILITY	No errors	at least 99% of the time	0 to 5	n/a	1
R213	WATER SOURCE	No errors	at least 90% of the time	0 to 9	n/a	1
R214	DISTANCE TO WATER SOURCE	<100' +/-10', >100' +/-100'	at least 90% of the time	0 – 100, 150,250,etc., 999	n/a	1
R215	SITE CLASS	+/- 1 class	at least 99% of the time	1 to 7	n/a	5
R216	FIRE	No errors	at least 99% of the time	0,1	n/a	1
R217	GRAZING	No errors	at least 99% of the time	0,1	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
R218	CONDITION LEVEL NOTES	When applicable	When applicable	English, alpha-numeric	n/a	1 to 5
Boundary References						
3201	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
3202	PLOT TYPE	No errors	at least 99% of the time	1 to 3	n/a	1
3203	BOUNDARY CHANGE	No errors	at least 99% of the time	0 to 3	n/a	1
3204	CONTRASTING CONDITION	No errors	at least 99% of the time	1 to 9	n/a	1
3205	LEFT AZIMUTH	+/- 5 degrees	at least 90% of the time	001 to 360	degrees	3
3206	CORNER AZIMUTH	+/- 5 degrees	at least 90% of the time	000 to 360	degrees	3
3207	CORNER DISTANCE	+/- 1 ft,Microplt +/- 3 ft,Subplt	at least 90% of the time	microplot: 1 to 7 subplot: 1 to 24	feet	3
3208	RIGHT AZIMUTH	+/- 5 degrees	at least 90% of the time	001 to 360	degrees	3
Subplot Data						
4010	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
4020	SUBPLOT CENTER CONDITION	No errors	at least 99% of the time	1 to 9	n/a	5
4030	MICROPLOT CENTER CONDITION	No errors	at least 99% of the time	1 to 9	n/a	5
4080	SUBPLOT CONDITION LIST	No errors	at least 99% of the time	1000 to 9876	n/a	1
4040	SUBPLOT SLOPE	+/- 10 %	at least 90% of the time	000 to 155	percent	1
4050	SUBPLOT ASPECT	+/- 10 degrees	at least 90% of the time	000 to 360	degrees	1
4060	SNOW/WATER DEPTH	+/- 0.5 ft	At the time of measurement	0.0 to 9.9	feet	1
R401 R403 R405 R407	INVASIVE/EXOTIC PLANT 1	No errors	at least 90% of the time	See Field Guide for Invasive/Exotic Pest plants	n/a	1
R402 R404 R406 R408	PLANT PERCENT COVERAGE	No errors	at least 90% of the time	1 to 4, 9	n/a	1
Tree and Sapling Data						
R501	ENTRY NUMBER	No errors	At least 99% of the time	001 to 200	n/a	1
5010	SUBPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
5020	TREE RECORD NUMBER	No errors	at least 99% of the time	000, 001 to 999	n/a	1
R508	PRISM POINT# TREE #	No errors	at least 99% of the time	000, 001 to 999	n/a	1
5030	CONDITION CLASS NUMBER	No errors	at least 99% of the time	1 to 9	n/a	1
5040	AZIMUTH	+/- 3 degrees	at least 90% of the time	001 to 360	degrees	1
5050	HORIZONTAL DISTANCE	microplot:+/- 0.2ft subplot: +/- 1.0 ft	at least 90% of the time	microplot: 00.1 to 6.8 subplot: 00.1 to 24.0 annular plot: 00.1 to 58.9	feet	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
5060	PRESENT TREE STATUS	No errors	at least 95% of the time	0 to 4	n/a	5
R507	CO-LOCATED MICROPLOT TREE STATUS	No errors	at least 95% of the time	0 to 4	n/a	5
R509	PRISM TREE STATUS	No errors	at least 95% of the time	0 to 4	n/a	5
R510	PAST TREE STATUS	No errors	at least 95% of the time	0to 4	n/a	5
5061	NEW TREE RECONCILE	No errors	at least 95% of the time	1 to 4	n/a	5
5070	LEAN ANGLE	No errors	at least 99% of the time	0, 1	n/a	1
5080	SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 3	n/a	2
5092	PRESENT DIAMETER	+/- 0.1 inch per 20 inches of diameter on trees with a measured diameter	at least 95% of the time	001 to 999	inches	Saps & Snags = 1, Pole & Saw = 5
5091	PAST DIAMETER	No errors	at least 99% of the time	001 to 999	inches	1
5100	DIAMETER CHECK	No errors	at least 99% of the time	0 to 2	n/a	1
5230	*LENGTH TO DIAMETER MEASURE-MENT POINT*	*+/- 0.2 ft*	*at least 90% of the time*	*0.1 to 15.0*	*inches*	*1*
R503	TREE CLASS	No errors	at least 90% of the time	2, 3, 4	n/a	5
5150	CROWN CLASS	No errors	at least 85% of the time	1 to 5	n/a	2
5170	COMPACTED CROWN RATIO	+/- 10%	at least 80% of the time	00 to 99	percent	1
R504	TREE GRADE	No errors	at least 90% of the time	1 to 5	n/a	2
R502	BOARD FOOT CULL	+/- 10%	at least 90% of the time	0 to 99	percent	2
5110	ROTTEN / MISSING CULL	+/- 10%	at least 90% of the time	0 to 99	percent	2
5120	TOTAL LENGTH	+/- 10% of true length	at least 90% of the time	005 to 400	feet	Saps & Snags = 1, Pole & Saw = 5
5130	ACTUAL LENGTH	+/- 10% of true length	at least 90% of the time	005 to 400	feet	Saps & Snags = 1, Pole & Saw = 5
5140	LENGTH METHOD	No errors	at least 99% of the time	1 to 3	n/a	1
R505	FUSIFORM RUST AND DIEBACK	No errors	at least 80% of the time	0 to 2	n/a	1
R506	DIEBACK SEVERITY	+/- 1 class	at least 80% of the time	1 to 9	class	1
5181 5184	DAMAGE LOCATION 1, 2	+/- 1 location class	at least 80% of the time	0 to 9	class	1
5182 5185	DAMAGE TYPE 1, 2	No errors	at least 80% of the time	01-05; 11-13; 20-25; 31	n/a	1
5183 5186	DAMAGE SEVERITY 1, 2	No errors	at least 80% of the time	Defined for each DAMAGE TYPE	class	1
5190	CAUSE OF DEATH	No errors	at least 80% of the time	10 to 90	n/a	1

Item#	Variable Name	Tolerance	MQO	Values	Units	Factor
5200	MORTALITY YEAR	+/- 1year for 5-year measure. cycles +/- 2years for > 5-year measure. cycles	at least 70% of the time	1996 or higher	year	1
5210	DECAY CLASS	+/- 1 class	at least 90% of the time	1 to 5	class	1
5220	UTILIZATION CLASS	No errors	at least 99% of the time	00, 11-12	n/a	1
5260	TREE NOTES	n/a	n/a	English, alpha-numeric	n/a	n/a
Seedling Data						
6010	MICROPLOT NUMBER	No errors	at least 99% of the time	1 to 4	n/a	1
6030	CONDITION CLASS	No errors	at least 99% of the time	1 to 9	n/a	1
6020	SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 3	n/a	1
6040	SEEDLING COUNT	No errors	at least 95% of the time	1 to 5 exact count 6 more than 5 individuals by species by condition class	number	1
Site Tree Information						
7021	CONDITION CLASS LIST	No errors	at least 99% of the time	1 to 9 or 10000 to 98765	n/a	1
7022	SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 4	n/a	1
7023	DIAMETER	+/- 0.1 inch per 20 inches of diameter on trees with a measured diameter	at least 95% of the time	001 to 999	inches	1
7024	SITE TREE LENGTH	+/- 10% of true length	at least 90% of the time	001 to 999	feet	1
7025	TREE AGE AT DIAMETER	+/- 5 years	at least 95% of the time	001 to 999	year	1
7026	SITE TREE NOTES	When applicable	When applicable	English, alpha-numeric	n/a	1 to 5
7027	*SUBPLOT NUMBER*	*No errors*	*at least 99% of the time*	*1 to 4*	*n/a*	*1*
7028	*AZIMUTH*	*+/- 10 degrees*	*at least 90% of the time*	*001 to 360*	*degrees*	*1*
7029	*HORIZONTAL DISTANCE*	*+/-5 ft*	*at least 90% of the time*	*000.1 to 200.0*	*feet*	*1*

MISSED/ADDED CONDITIONS
If the cruiser misses or adds a condition, either forested or non-forested, include a 26-point deduction in the total error column for missed/added conditions on the QA scoresheet. If, on a plot with at least one forest condition, the cruiser does not delineate multiple non-forest conditions on a plot when more than one non-forest conditions exists (i.e., pasture and census water) then include a 5-point deduction for each non-forest condition missed on the plot in the total error column for missed/added conditions on the QA scoresheet.

APPENDIX 7

GLOSSARY

Accessible Forest Land – Land that is within sampled area (the population of interest), is accessible and can safely be visited, and meets at least one of the two following criteria:

a) the condition is at least 10-percent stocked by trees of any size (appendix 3) or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, grazing, or recreation activities, or
b) in several western woodland types where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, grazing, or recreation activities.

Accessible Other Forest Land – Land that meets the definition of accessible forest land, but is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions (SITE CLASS = 7). Note: adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness and rockiness

Accessible Timberland – Land that meets the definition of accessible forest land and is capable of producing at least 20 cubic feet per acre per year of industrial wood under natural conditions. (SITE CLASS = 1-6)

ACTUAL LENGTH – For trees with broken or missing tops. The actual length of the tree is recorded to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. If the top is intact, this item may be omitted. Forked trees should be treated the same as unforked trees.

Agricultural Land – Land managed for crops, pasture, or other agricultural use. Evidence includes geometric field and road patterns, fencing, and the traces produced by livestock or mechanized equipment. The area must be at least 1.0 ac in size and 120.0 ft. wide at the point of occurrence.

Annular Plot – A circular, fixed area plot with a radius of 59.0 feet. Annular plots may be used for sample intensification or for sampling relatively rare events.

ARTIFICIAL REGENERATION SPECIES – Indicates the predominant species that is planted or seeded in an artificially regenerated condition.

Blind check – a re-installation done by a qualified inspection crew without production crew data on hand; a full re-installation of the plot for the purpose of obtaining a measure of data quality. The two data sets are maintained separately. Discrepancies between the two sets of data are not reconciled. Blind checks are done on production plots only.

BOARD-FOOT CULL -- Solid wood cull due to sweep, crook and excessive knot collars, as well as unsound cull due to rotten or missing wood. Board-foot cull is expressed as a percentage of the sawlog portion of the tree.

Bole – The main stem of a tree, extending from one foot above the ground to the point on the tree where DOB reaches 4 inches

Boundary – The intersection of two or more conditions on a subplot or microplot. Each boundary is described by recording the azimuth and horizontal distance from the subplot or microplot center to the left and right points of where the boundary intersects the perimeter of the subplot or microplot. An azimuth and distance to a corner point may also be described, if one exists. If multiple boundaries exist at a subplot, they are recorded in the order of their occurrence on the subplot, starting from north and proceeding around the compass.

Census Water – Rivers and streams that are more than 200 feet wide and bodies of water that are greater than 4.5 acres in size.

Certification plot – a plot installed by a certification candidate. It may be a training plot or a production plot. The candidate working alone installs the plot.

Cold check – an inspection done either as part of the training process, or as part of the ongoing QC program. Normally the installation crew is not present at the time of inspection. The inspector has the completed data in-hand at the time of inspection. The inspection can include the whole plot or a subset of the plot. Data errors are corrected. Cold checks are done on production plots only.

CONDITION CLASS – The combination of discrete landscape and forest attributes that identify and define different strata on the plot. Examples of such attributes include condition status, forest type, stand origin, stand size, owner group, reserve status and stand density.

CONTIGUOUS FOREST LAND – Forested areas with tree cover =120 feet wide. Boundaries are non-forested areas =120 feet wide. Boundaries are not defined by ownership, forest type, or age class. Rights-of-way (powerline, pipeline, woods road, improved road) are not boundaries unless the cleared area between trees is =120 feet in width.

Cropland – Land under cultivation within the past 24 months, including orchards and land in soil improving crops, but excluding land cultivated in developing improved pasture.

CROWN CLASS – A classification of trees based on dominance in relation to adjacent trees within the stand as indicated by crown development and the amount of sunlight received from above and sides.

Cruising stick – Stick marked at 4.5 feet used to locate DBH.

CUBIC-FOOT CULL – An assessment of the rotten, missing, or otherwise defective portions of a tree bole that are unsuitable for industrial wood products. Cubic-foot cull is expressed as a percentage of the entire bole.

Cull – Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect. (See cubic-foot cull and board-foot cull.)

Diameter at Breast Height (DBH) – The diameter of the bole of a tree at breast height (4.5 feet above the ground), measured outside of the bark.

Diameter at Root Collar (DRC) – The diameter of a tree measured at the ground line or stem root collar, measured outside of the bark.

Diameter Outside Bark (DOB) – A diameter that may be taken at various points on a tree, or log, **outside** of the bark. Diameter Outside Bark is often estimated.

Face -- A section of the tree surface (usually within the butt sixteen feet) that is ¼ of the circumference of the tree and extending the full length of the log.

Federal Information Processing Standard (FIPS) – A unique code identifying U.S. States and counties (or units in Alaska).

Forest Industry Land – Land owned by companies or individuals that operate wood-using plants.

Forest Land – Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and is not currently developed for a nonforest use. The minimum area for classification as forest land is one acre. Roadside, stream-side, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas shall be classified as forest, if less than 120 feet in width or an acre in size. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied. (Also see definitions of nonforest land, idle farmland and improved/maintained pasture.)

Forest Trees – Plants having a well-developed, woody stem and usually more than 12 feet in height at maturity.

FOREST TYPE – A classification of forest land based upon the trees or tree communities that constitute the majority of stocking on the site.

GPS – Global Positioning System. Information from this system is collected and used to determine the latitude and longitude of each plot.

Growing Stock Tree – Trees with one-third or more of the gross board foot volume in the entire sawlog section with commercial logs meeting grade soundness, and size requirements or the potential to do so for poletimber-sized trees. A TREE CLASS = 2 must have one 12-foot log or two 8-foot logs, now or prospectively, for live poletimber-sized trees to qualify as growing stock. Mortality pole size trees can never grow to be sawlog size, so are never TREE CLASS = 2.

Hardwoods – Dicotyledonous trees, usually broad-leaved and deciduous.

Hot check – an inspection normally done as part of the training process. The inspector is present on the plot with the trainee and provides immediate feedback regarding data quality. Data errors are corrected. Hot checks can be done on training plots or production plots.

Idle Farmland -- Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent stocking with live trees.

Improved Pasture -- Land that is currently maintained and used for grazing. Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds, periodic brush removal, seeding, irrigation, or mowing.

Inclusion – An area that would generally would be recognized as a separate condition, except that it is not large enough to qualify. For example, a ½ acre pond within a forested stand.

Industrial Wood – All roundwood products, except firewood.

Inspection crew – a crew of qualified QC/QA individuals whose primary responsibility is the training, certification and inspection of production crews.

Intensification plots – additional points that are photo interpreted for forest or nonforest land use and checked on the ground for detailed land use. These samples are used to strengthen the ground check of the photo interpretation.

Land Area – As defined by the Bureau of the Census: The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean tide); streams, sloughs, estuaries and canals less than 200 feet in width, and ponds less than 4.5 acres in area.

Limbs – That part of a tree above the stump which does not meet the requirements for sawlog and upper-stem portions, including all live, sound branches to a minimum of 4 inches DOB at the knot collar.

Maintained Road – Any road, hard topped or other surfaces, that is plowed or graded periodically and capable of use by a large vehicle. Rights-of-way that are cut or treated to limit herbaceous growth are included in this area.

Marsh – Low, wet areas characterized by heavy growth of weeds and grasses and an absence of trees.

Measurement Quality Objective (MQO) – Describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance.

Merchantable Sawtimber Top – The point on the bole of sawtimber trees above which a sawlog cannot be produced. Minimum merchantable top is 7.0 inches DOB for softwoods and 9.0 inches DOB for hardwoods.

Microplot – A circular, fixed-radius plot with a radius of 6.8 feet that is used to sample trees less than 5.0 inches at DBH, as well as other vegetation.

National Forest Land – Federal lands which have been legally designated as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Native American (Indian) Land – Tribal lands held in fee, or trust, by the Federal government but administered for Indian tribal groups and Indian trust allotments. This land is considered “Private Lands”, Owner Group 40.

Net volume – Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Non-census Water – Bodies of water from 1 to 4.5 acres in size and water courses from 30 feet to 200 feet in width.

Nonforest Land -- Land that does not support, or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than one acre in size, to qualify as nonforest land.

Nonstockable – Areas of forest land that are not capable of supporting trees because of the presence of rock, water, etc.

Other Federal Lands – Federal land other than National Forests. These include lands administered by the USDI Bureau of Land Management, USDI National Park Service, USDI Fish and Wildlife Service, Department of Defense, Department of Energy, Army Corps of Engineers, and military bases.

Overgrown Knot – The scar left in the bark by a limb that has been completely overgrown, but still outlined by the circular configuration in the bark.

OWNER CLASS -- A variable that classifies land into fine categories of ownership.

OWNER GROUP – A variable that classifies land into broad categories of ownership; Forest Service, Other Federal Agency, State and Local Government, and Private. Differing categories of Owner Group on a plot require different conditions.

Permanent water – Canals, ponds, lakes, streams or swamps that, barring severe drought, will contain water year-round.

Phase 1 (P1) – FIA activities done as part of remote-sensing and/or aerial photography.

Phase 2 (P2) – FIA activities done on the network of ground plots formerly known as FIA plots.

Phase 3 (P3) – FIA activities done on a subset of Phase 2 plots formerly known as Forest Health Monitoring plots. Additional ecological indicator information is collected from Phase 3 plots.

Plot – A cluster of four subplots that samples approximately 1/6 acre. The subplots are established so that subplot 1 is centered within the sample and the centers of subplots 2, 3,and 4 are located 120 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and annular plot

Poletimber-size trees – Trees at least 5.0 inches in diameter at breast height, but smaller than sawtimber size.

PRIVATE OWNER INDUSTRIAL STATUS – Indicates whether Private land owners own and operate a wood processing plant.

Production crew – a crew containing at least one certified individual. The crew is involved in routine installation of plots.

Production plot – a plot that belongs to the 6000-acre grid database. It may also be used for training purposes.

REGENERATION STATUS – A stand descriptor that indicates whether a stand has been naturally or artificially regenerated.

Regional drift – the tendency for standards, methods and interpretations to drift apart over time as each unit implements the FIA core protocol.

Reserved Land – Land that is withdrawn from timber utilization by a public agency or by law.

Reversion – A sample location or portion of a sample location that was non-forest in the previous inventory, but is now forest.

RESERVE STATUS – An indication of whether the land in a condition has been reserved.

Rotten Cull Tree – A live tree with less than 1/3 of its gross board-foot volume in logs that meet size, soundness and grade requirements, and more than ½ of the cubic-foot volume is rotten. Or, a live poletimber size that prospectively will have less than 1/3 of its gross board-foot volume in logs that meet size, soundness and grade requirements, and more than ½ of the cubic-foot volume is rotten.

Rough Cull Tree – A live tree with less than 1/3 of its gross board-foot volume in logs that meet size, soundness and grade requirements, and more than ½ of the cubic-foot volume is sound. Or, a live poletimber size that prospectively will have less than 1/3 of its gross board-foot volume in logs that logs that meet size, soundness and grade requirements, and more than ½ of the board-foot cull is due to sound defects such as sweep, crook, etc.

Roundwood Products – Logs, bolts or other round sections cut from trees for industrial or consumer uses. (Note: includes sawlogs veneer logs and bolts; cooperage logs and bolts; pulpwood, fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead trees – Standing or down dead trees 5.0 inches DBH and larger that are currently merchantable. Tree class 2 and 3 trees can be salvable dead trees.

Saplings – Live trees 1.0 to 4.9 inches DBH.

Sawlog portion – That part of the bole of sawtimber-size trees between the stump and the sawlog top (7.0 inches DOB for softwoods, 9.0 inches DOB for hardwoods.)

Sawtimber-size trees – Softwoods must be at least 9.0 inches in diameter at breast height and hardwoods must be at least 11.0 inches in diameter at breast height.

Seedlings – Live hardwood trees less than 1.0 inch DBH that are at least one foot tall and live softwood trees less than 1.0 inch DBH that are at least 6 inches tall. Longleaf pine has no minimum length, but must be ½ -inch diameter at the root collar .

Site Class – A classification of forest land that indicates the potential capacity to grow crops of industrial wood based on fully stocked natural stands.

Softwoods – Coniferous trees, usually evergreen having needles or scale-like leaves.

STAND AGE – A stand descriptor that indicates the average age of the live trees not overtopped in the predominant stand size-class of a condition.

STAND DENSITY – A stand descriptor that indicates the relative tree density of a condition class. The classification is based on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class tree density.

STAND SIZE – A stand descriptor that indicates which size-class of trees that are not overtopped constitutes the majority of stocking in the stand.

Standing dead *(snags)* – Standing dead trees 5.0 inches in diameter and larger, at least 4.5 feet tall, and less than 45 degrees lean from vertical. Trees do NOT have to be self-supported. They may be supported by other trees.

State, County and Municipal Lands – Lands owned by states, counties, and local public agencies or municipalities, or lands leased to these government units for 50 years or more.

Stocking – The relative degree of occupancy land by trees, measured as basal area or the number of trees in a stand by size or age and spacing, compared to the basal area or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

Sound Knot or Limb – Knots or limbs that are intergrown, or encased, with the surrounding wood, and that show no sign s of decay. Bark may not be present on the limbs.

Subplot – A circular, fixed-area plot with a radius of 24.0 feet. Each subplot represents ¼ of the fixed plot sample unit.

TOTAL LENGTH – The total length of the tree, recorded to the nearest 1.0 ft from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, the total length is estimated to what the length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees

Training plot – a plot established for training or certification purposes only. It does NOT belong to the 6000-acre grid database.

Transition Zone – An area where a distinct boundary between two or more different conditions cannot be determined.

TREE GRADE – A classification base on external characteristics as indicators of quality or value.

Upper Stem Portion – The part of the bole of sawtimber trees above the sawlog top to a minimum top diameter of 4.0 inches DOB, or to the point where the central stem breaks into limbs.

APPENDIX 8

BLANK PAGES FOR NOTES

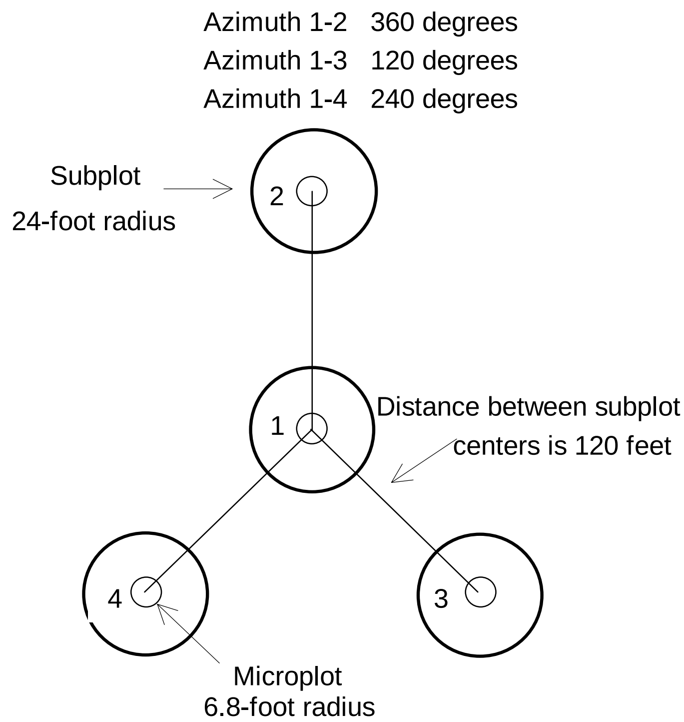
SUPPLEMENT A

SOUTHERN STATION
FIXED RADIUS SUBPLOT DESIGN AND MICROPLOT REMEASUREMENT PROCEDURES

REVIEW OF FIELD SAMPLING IN PREVIOUS INVENTORY

This section is an overview of the previous subplot design installed by the Southern Station in AL, AR, GA, KY, LA, NC, SC, TN, and VA.

PLOT LAYOUT



LAND USE

The size requirements of the land use definitions have not changed – 120 ft wide and 1.0 acre in size, except for urban land uses which still can be any size or width.

However, the land use boundaries have changed. In the past inventory, developed nonforest conditions, (i.e. improved roads, rights-of-ways, etc.) were considered forest boundaries regardless of width.

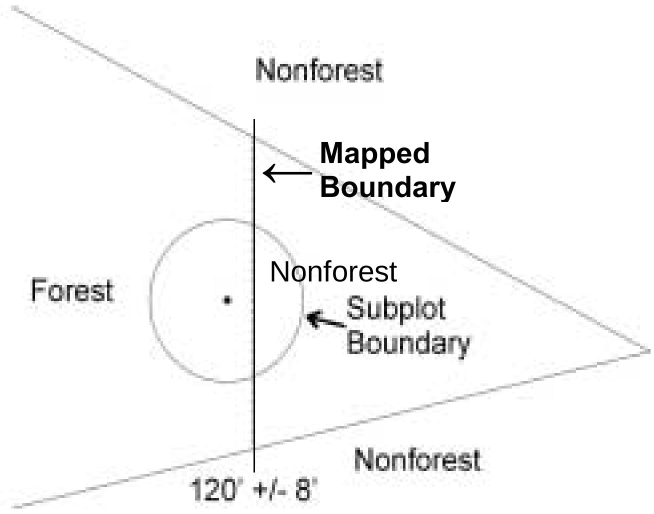
In the current inventory, the same rules for SIZE OF CONTIGUOUS FOREST LAND boundaries, now apply to LAND USE as well: only nonforest entities greater than 120 ft wide are considered forest boundaries. For example, an improved road that is 60 feet wide does not stop the forest land use from crossing the road and capturing the adjacent forest on the other side, even though the improved road is considered as a nonforest condition. Therefore, land that was recorded as nonforest at the last inventory may now meet the definition of forest land.

CONDITION DELINEATION

In the previous subplot design, an accessible forest condition that was as narrow as 30 ft wide could be delineated as a separate condition. In the current inventory, the forest condition must be 120 ft in order to delineate it as a separate accessible forest land condition.

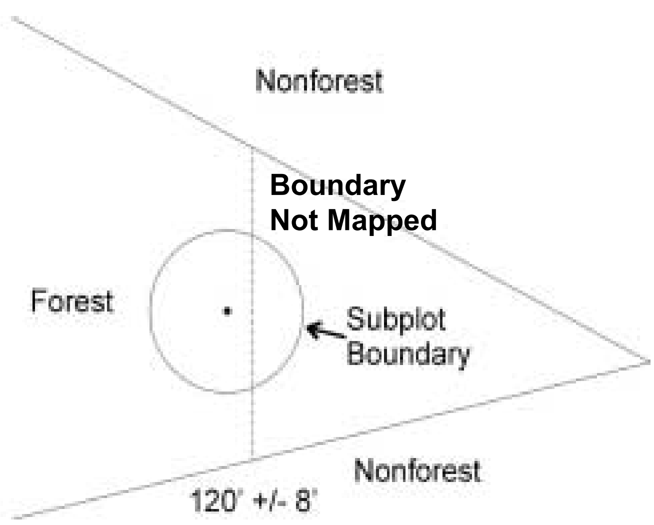
When delineating forest land and nonforest land, the past procedures required that a reference boundary be identified, and the condition delineated when the subplot straddled an area that was less than 120 ft wide. For example, a subplot fell in an area that was completely wooded, but a portion of the wooded area was less than 120 ft wide and surrounded by nonforest land. The portion that was less than 120 ft was recorded as a nonforest condition and the subplot was mapped (see Figure 35 below).

Figure 36. Forest condition narrowed within a nonforest condition. In the past survey, the line representing the 120' boundary was mapped, and the area to the right of the line was considered to be part of the Nonforest condition surrounding it. Only the trees that fell on to the left of the boundary were tallied.



In the current inventory, the entire subplot will be considered to be forest or nonforest, depending on where subplot center lands on the ground. If the subplot center samples the area that is greater than 120 ft wide, then the whole subplot is considered to be part of that condition. If the subplot center samples the area that is less than 120 ft wide, then the whole subplot is considered to be part of that condition (see Figure 5 below, and Section 2.3.1)

Figure 5. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120 ft wide. In this example, the entire subplot is classified as forest.



PREVIOUS DIAMETER PROCEDURES

DBH on a tree that had an abnormality at 4.5, was estimated by averaging the diameter above and below the abnormality and recording VALID DBH = 1. The current procedure is to take the diameter immediately above the abnormality at the point where it ceases to affect normal stem form. The length to DBH is also recorded. All other DBH procedures have not changed since the previous inventory.

CO-LOCATED MICROPLOT REMEASUREMENT PROCEDURES

This section describes the tree level variables that are recorded when remeasuring the co-located microplot on the Southern FIA unit's fixed radius subplot design. Only account for the saplings recorded at the last inventory, missed saplings, and through growth trees. Do not tally any new ingrowth saplings.

NO HISTORY

For stems that are not presently in the sample, either due to previous cruiser error or due to definitional or procedural change, denied access, inaccessible/hazardous conditions, or a lost microplot, retain the same TREE RECORD NUMBER, then do the following:

- record CO-LOCATED MICROPLOT TREE STATUS = 0
- record the required items listed below in this supplement

LIVE STEMS

For live saplings on the co-located microplot that were recorded as saplings at the previous inventory and are currently still less than 5.0 inches DBH:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record CO-LOCATED MICROPLOT TREE STATUS = 1
- record the required items listed below in this supplement

For live saplings that are on both the previous co-located and the new off-set microplots:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 1, and record CO-LOCATED MICROPLOT TREE STATUS = 1
- record the required sapling tally items in Section 5.0
- be sure to get an azimuth and distance to the new off-set microplot

For live stems on the co-located microplot that were recorded as saplings at the previous inventory and have grown to 5.0 inches or greater since the previous inventory:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 1, and record CO-LOCATED MICROPLOT TREE STATUS = 1record the required tree tally items described in Section 5.0
- be sure to get an azimuth and distance to subplot center

THROUGH GROWTH TREES

For live stems on the co-located microplot that were seedlings at the previous inventory and have grown to 5.0 inches or greater since then:

- record the next available TREE RECORD NUMBER
- record PRESENT TREE STATUS = 1
- record CO-LOCATED MICROPLOT TREE STATUS = 1
- record NEW TREE RECONCILE = 2 (through growth)
- record the required tree tally items described in Section 5.0
- be sure to get an azimuth and distance to subplot center

MISSED TREES
Be wary of recording saplings as missed trees. Unless it is obvious that the previous cruiser was in error, give the benefit of the doubt. However, if it is determined that the tree definitely should have been tallied as a sapling at the previous inventory but was not tallied, then do the following:

- record the next available TREE RECORD NUMBER
- record CO-LOCATED MICROPLOT TREE STATUS = 1 if alive
- also record PRESENT TREE STATUS = 1 if alive AND ≥ 5.0 in DBH
- record CO-LOCATED MICROPLOT TREE STATUS = 2 if dead
- also record PRESENT TREE STATUS = 2 if dead AND ≥ 5.0 in DBH
- record NEW TREE RECONCILE = 3 (missed)
- if tree is less than 5.0 inches, record the required items listed in this supplement
- if tree is 5.0 inches or greater, then record the required items listed in Section 5.0

DEAD STEMS
For dead stems that were recorded as live saplings at the previous inventory and are currently less than 5.0 inches DBH:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record CO-LOCATED MICROPLOT TREE STATUS = 2
- record the required items listed in this supplement

For dead stems on the co-located microplot that were recorded as live saplings at the previous inventory but are currently 5.0 inches or greater:

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record PRESENT TREE STATUS = 2
- record CO-LOCATED MICROPLOT TREE STATUS = 2
- record the required tree tally items described in Section 5.0

REMOVAL TREES

- retain the same TREE RECORD NUMBER recorded at the previous inventory
- record CO-LOCATED MICROPLOT TREE STATUS = 3
- record the required items listed in this supplement

MISSING SAPLINGS
If a live sapling has been physically moved off the co-located microplot, and is not now on the off-set microplot (or the subplot if ≥ 5.0 inches DBH), then:

- record CO-LOCATED MICROPLOT TREE STATUS = 4
- record the required items listed below in this supplement

If a live sapling has been physically moved off the co-located microplot, is still less than 5.0 inches DBH, and is now on the new off-set microplot:

- record CO-LOCATED MICROPLOT TREE STATUS = 4
- record PRESENT TREE STATUS = 1
- record the required tree tally items described in Section 5.0

If a live sapling has moved off the co-located microplot, has grown up to 5.0 inches or greater, and is now on the subplot:

- record CO-LOCATED MICROPLOT TREE STATUS = 4
- record PRESENT TREE STATUS = 1
- record NEW TREE RECONCILE = 1.
- record the required tree tally items described in Section 5.0

If a sapling has grown up to 5.0 inches or greater, has been physically moved off the co-located microplot, is now on the subplot, but has since died:

- record CO-LOCATED MICROPLOT TREE STATUS = 4
- record PRESENT TREE STATUS = 2
- record the required tree tally items described in Section 5.0

DATA RECORDED

Record the following tree level variables on the co-located microplot tally:

ITEM R501 ENTRY NUMBER
ITEM 5010 MICROPLOT NUMBER
ITEM 5020 TREE RECORD NUMBER
ITEM 5030 CONDITION CLASS NUMBER
ITEM R507 CO-LOCATED MICROPLOT TREE STATUS
ITEM 5061 NEW TREE RECONCILE
ITEM 5080 SPECIES
ITEM 5092 DIAMETER AT BREAST HEIGHT
ITEM 5091 PREVIOUS DIAMETER AT BREAST HEIGHT
ITEM 5100 DIAMETER CHECK
ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT
ITEM R503 TREE CLASS
ITEM 5120 TOTAL LENGTH
ITEM 5130 ACTUAL LENGTH
ITEM 5140 LENGTH METHOD
ITEM 5190 CAUSE OF DEATH
ITEM 5200 MORTALITY YEAR
ITEM 5220 UTILIZATION CLASS
ITEM 5260 TREE NOTES

ITEM R501 ENTRY NUMBER

The entry number is pre-printed on tally sheets and is automatically created in Excel. If an entry is crossed out or omitted for any reason, subsequent entry numbers must be manually renumbered.

When collected: All reamusurement saplings on the collected microplot
Field width: 3 digits
Values: 001 to 999

ITEM 5010 MICROPLOT NUMBER (CORE 5.01)

Record the microplot number where the tree occurs.

When Collected: All remeasurement saplings on the co-located microplot
Field width: 1 digit
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

ITEM 5020 TREE RECORD NUMBER

Record the tree number assigned at the previous visit. Do not renumber trees in order to assign a more “correct” tree number to a missed tree and to trees that have grown onto the subplot. If the previous tree number was a two-digit code, change it to a three-digit code by placing a zero in front of it. Record 999 for co-located microplots that have no past tree tally. If a sapling is on both the co-located and the new off-set microplot, add 900 to the previous tree number.

When Collected: All remeasurement saplings on the co-located microplot
Field width: 3 digits
Values: 001 to 999

ITEM 5030 CONDITION CLASS NUMBER (CORE 5.03)

Record the condition class number in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 9).

When Collected: All remeasurement saplings on the co-located microplot
Field width: 1 digit
Values: 1 to 9

ITEM R507 CO-LOCATED MICROPLOT TREE STATUS

Record a current tree status code for each tree on the co-located microplot.

When Collected: All remeasurement saplings on the co-located microplot
Field width: 1 digit
Values:

0 No status –- tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous survey or currently is not tallied due to definition or procedural change.

1 Live tree – any live tree (remeasured or missed)

2 Dead tree -- any mortality tree, regardless of cause of death, which does not qualify as a removal.

3 Removal - a tree that has been cut or killed by direct human activity related to harvesting, silviculture or land clearing. The tree may, or may not, have been utilized. Only code trees killed by fire as removals if it was a prescribed burn.

4 Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc.

ITEM 5061 NEW TREE RECONCILE (CORE 5.6.1)

Record a NEW TREE RECONCILE for new tally trees on the co-located microplot that were less than 1.0 inch on the previous inventory and now are 5.0 inches or greater, or for saplings that were missed on the last inventory.

Be wary of recording saplings as missed trees. Unless it is obvious that the previous cruiser was in error, give the benefit of the doubt.
When Collected: On the co-located microplot; present DBH ≥ 5.0 inches and past DBH < 1.0 inch, and on missed live saplings
Field width: 1 digit
Values:

2 Through growth – new tally tree 5 inches DBH and larger, within the remeasured co-located microplot.
3 Missed live – a live tree on the remeasured co-located microplot missed at previous inventory and that is live, dead or removed now.

ITEM 5080 SPECIES (CORE 5.08)

Record the appropriate SPECIES code from the list in Appendix 3. If you encounter a species not listed in Appendix 3 and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use the generic SPECIES code only when you encounter a tree where you know tree species but the species is not on the species list.

When Collected: All tally trees
Field width: 3 digits
Values: See Appendix 3

ITEM 5092 DIAMETER AT BREAST HEIGHT (DBH) (CORE 5.09.2)

Unless one of the special situations described in Appendix 3 is encountered, measure DBH at 4.5 ft above the ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For example, a reading of 3.68 inches is recorded as 3.6 inches.

When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 3 digits (xx.y)
Values: 010 to 999

ITEM 5091 PREVIOUS DIAMETER AT BREAST HEIGHT (CORE 5.09.1)

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory onto the data recorder and/or on hardcopy.

When collected: All remeasurement tally trees
Field width: 3 digits (xx.y)
Values: 010 to 049

ITEM 5100 DIAMETER CHECK (CORE 5.10)

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses. Use code 2 for remeasurement trees only.

Note: If both codes 1 and 2 apply, use code 2.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 1 digit
Values:

0 Diameter measured accurately
1 Diameter estimated, or tree shrunk due to bark slough by less than 0.2 inch
2 Diameter measured at different location than previous measurement; the previous diameter was estimated and the current diameter is measured accurately; previous diameter is obviously incorrect; or the tree shrunk by more than 0.2 inch or more

ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.23)

For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual height from the ground, to the nearest 0.1 ft, at which the diameter was measured for each tally tree, 1.0 in DBH and larger.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 3 digits
Values: 001 – 150

ITEM R503 TREE CLASS

Record the code that indicates the tree class. All palm species are code 3.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1 and all mortality trees = 5.0 in DBH

Field width: 1 digit
Values:

2 Potential growing stock
3 Rough cull
4 Rotten cull

ITEM 5120 TOTAL LENGTH (CORE 5.12)

Record the TOTAL LENGTH of the tree, to the nearest 1.0 ft from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 3 digits
Values: 005 to 400

ITEM 5130 ACTUAL LENGTH (CORE 5.13)

For trees with broken or missing tops, record the ACTUAL LENGTH of the tree to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. If the top is intact, this item may be omitted. Forked trees should be treated the same as unforked trees.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 3 digits
Values: 005 to 400

ITEM 5140 LENGTH METHOD (CORE 5.14)

Record the code that indicates the method used to determine tree lengths. Instruments are to be used on all trees when possible. Do not measure a few trees on the subplot and then estimate the rest visually. Only estimate length when it is not possible to accurately measure it with an instrument.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1
Field width: 1 digit
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape)

2 Total length is visually estimated, actual length is measured with an instrument

3 Total and actual lengths are visually estimated

ITEM 5190 CAUSE OF DEATH

Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 2or 3
Field width: 2 digits
Values:

10	Insect	60	Vegetation (suppression, competition, vines/kudzu)
20	Disease	70	Unknown/not sure/other
30	Fire	80	Human
40	Animal	90	Physical (hit by falling tree)
50	Weather		

ITEM 5200 MORTALITY YEAR (CORE 5.20)

Record the estimated year that remeasured trees died or were cut. For each remeasured tree that has died or been cut since the previous inventory, record the 4-digit year in which the tree died. Mortality year is also recorded for trees on land that has been converted to a nonforest land use, if it can be determined that a tree died before the land was converted.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 2or 3
Field width: 4 digits
Values: 19xx or higher

ITEM 5220 UTILIZATION CLASS (CORE 5.22)
Record the code to identify cut trees that have been removed from the site.

When Collected: CO-LOCATED MICROPLOT TREE STATUS = 1 or 3
Field width: 2 digits
Values:

00 Not utilized - can still be found on the site, or, if not actually found on the site, the cruiser estimates that due to past DBH, species, or from other information, that the tree was not removed from the site for use as a product, either commercially or non-commercially.

11 Commercial utilization – some portion of the tree removed for commercial purposes. Commercial uses include sawlogs, pulpwood, veneer logs, poles, and other products such as firewood cut by commercial firewood operations.

12 Non-commercial utilization – some portion of the tree removed for non-commercial purposes. Non-commercial uses include domestic firewood use, barn poles, fence posts, domestic landscaping, rough slabs, etc.

Trees that have been cut above 4.5 ft (“jump-butt”) due to a fence or defect are tallied if still standing at 4.5 ft. If the tree is still alive at DBH, then record TREE STATUS = 1 and then record UTILIZATION = 11 or 12. If it is dead at DBH, then record TREE STATUS = 2 and UTILIZATION = 11 or 12. However, this does NOT apply to naturally swell-butted trees where it is normal to cut above 4.5 ft. Continue to code those trees as removals (TREE STATUS 3) if cut below the diameter point and then code UTILIZATION = 11 or 12.

ITEM 5260 TREE NOTES (CORE 5.26)
Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All live and dead tally trees
Field width: Alphanumeric character field
Values: English language words, phrases and numbers

SUPPLEMENT B

PREVIOUS PRISM PLOT DESIGNS AND REMEASUREMENT PROCEDURES

(AR, FL, LA, MS, NC, OK, TX)

REVIEW OF FIELD SAMPLING IN PREVIOUS SOUTHERN RESEARCH STATION INVENTORY (AR, LA, MS, OK, TX)

This section is an overview of the previous prism plot design installed by the former Southern Station.

SAMPLE LOCATIONS

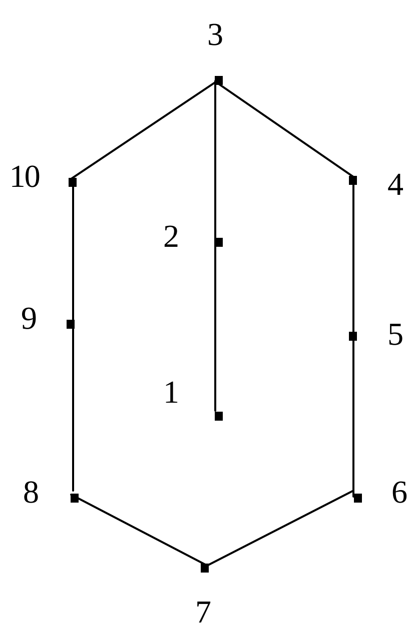
Sample locations were taken at the intersections of a 3-mile grid. At this sampling intensity, a plot location represented approximately 5,760 similar acres. One forest plot location was a cluster of ten points systematically spaced within the boundaries of an acre.

PLOT LAYOUT

The spacing and orientation of the point cluster results in equilateral triangles, with sides 66 feet in length, between points.

10-POINT CLUSTER DESIGN

Azimuth	and	Distance	from	Point	to	Point
000		66 ft		1		2
000		66 ft		2		3
120		66 ft		3		4
180		66 ft		4		5
180		66 ft		5		6
240		66 ft		6		7
300		66 ft		7		8
000		66 ft		8		9
000		66 ft		9		10



At each forested location, ten points were sampled using a 37.5 basal area factor prism to select live trees 5.0 inches DBH and larger. Additionally, all live trees 1.0 through 4.9 inches DBH within a 7.1-foot radius plot were tallied at points 1, 2, and 3. At points 4-10, up to the four most dominant 1.0 to 4.9 inch trees were tallied if fewer than two live variable plot trees were tallied at the point. If there were no live trees or live saplings on any point, then up to the four most dominant seedlings were tallied at the point.

All points were marked with a wire pin. Three witness trees were marked with brass tags and scribed with an “X” at point one. Instructions for plot recovery were recorded. These instructions included a description of the starting point, and the azimuth and distance from the starting point (SP) to plot center (PC), at point 1. All azimuths were measured from magnetic north.

DIAMETER PROCEDURES

Diameters of forked trees were taken 3.5 feet above the crotch intersection on the previous inventory. Diameters will be taken at 3.5 feet above the pith intersection in the current inventory. Record DIAMETER CHECK = 2 for these trees, even if the current diameter is estimated at the new measurement point.

If there was an abnormality at 4.5 ft, then the crew recorded the smallest diameter at a point below 4.5 ft where the diameter was not affected by the abnormality.

ROTATED POINTS

If any point fell in, or within 33 feet of, a non-forest area, the point was rotated into forest land. Rotated points are indicated in the diagram section of the previous inventory plot sheet. When a power line transected the point cluster, points were rotated to the same side as point 1.

PRISM POINT REMEASUREMENT PROCEDURES

This section describes the tree level variables that are recorded when remeasuring both the previous Southern FIA unit's 10-point variable radius plots and the previous Southeastern FIA unit's 5-point variable radius plots.

REMEASUREMENT TALLY

All trees 1.0 inch and larger on the previous inventory will be accounted for on prism points 1 through 3. Only those trees that were 5.0 inches or larger last inventory are remeasured on prism points 4 and 5. Additionally, trees within the 6.8-foot radius on prism points 1 through 3 that were less than 1.0 inch at the last inventory and have now grown to 5.0 inches or larger are recorded as through growth trees. Otherwise, never remeasure trees that were less than 1.0 inch at the previous survey.

NOTE: The previous Southern station measured all saplings within a 7.1-foot radius plot at all points. Ignore all saplings on points 4-5. Check all previous distances on saplings that were recorded between 6.8 and 7.1 feet. Only remeasure the saplings that are within a 6.8-foot radius on prism points 1-3. If a sapling was recorded within 6.8 feet at the last survey and now is beyond 6.8 feet, then code PRISM TREE STATUS = 0. Ignore any sapling measured beyond 6.8 feet in both the previous and current inventory.

Trees that are on both the old prism plot and the new mapped plot are tallied as a single tree entry. Record all required items listed here as well as all required mapped tree level variables for trees that are common to both plots (see Section 5.0).

DATA RECORDED

Record the following tree level variables on prism point trees:

ITEM R501 ENTRY NUMBER
ITEM R508 PRISM POINT#/TREE#
ITEM R509 PRISM TREE STATUS
ITEM 5061 NEW TREE RECONCILE
ITEM 5080 SPECIES
ITEM 5092 CURRENT DIAMETER AT BREAST HEIGHT (DBH)
ITEM 5091 PREVIOUS DIAMETER AT BREAST HEIGHT
ITEM 5100 DIAMETER CHECK
ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT
ITEM R503 TREE CLASS
ITEM 5110 PERCENT ROTTEN/MISSING CULL
ITEM 5120 TOTAL LENGTH
ITEM 5130 ACTUAL LENGTH
ITEM 5140 LENGTH METHOD
ITEM 5190 CAUSE OF DEATH
ITEM 5200 MORTALITY/NONFOREST YEAR
ITEM 5220 UTILIZATION CLASS
ITEM 5260 TREE NOTES

ITEM R501 ENTRY NUMBER

The entry number is pre-printed on tally sheets and is automatically created in Excel. If an entry is crossed out or omitted for any reason subsequent entry numbers must be manually renumbered.

When collected: All tally trees and entries to label no tally on sub/microplot
Field width: 3 digits
Values: 001 to 999

ITEM R508 PRISM POINT#/TREE

Record the 1 digit point number and the unique 2-digit tree number that was recorded in the previous survey. Never change the old point number or old tree number. Record the point number and two zeros for the tree number when there are no remeasurement trees on a prism point. Use the next available tree number when assigning new numbers to missed and volume ingrowth trees. Also, record the point#/tree#, azimuth and distance of missed and volume ingrowth trees in the Tree Notes item for check cruise purposes.

When collected: All remeasurement tally; entry to record no tally on prism point
Field width: 3 digits
Values: 100-599

ITEM 5040 AZIMUTH

If a tree is on both the mapped and prism plots, then record the azimuth from the subplot center for trees 5.0 inches DBH or larger, or from the off-set microplot center for saplings, to the center of the base of the tree**.** Record the azimuth to the nearest degree. Use 360 for due north. In the Tree Notes item, record the azimuth from the prism point to the center of the base of the tree, **only** on prism plot trees that are missed or through trees, or if the past azimuth is off by more than 10 degrees, for check cruise purposes. Azimuth is not required on trees that are only on the prism plot.

When collected: Remeasurement tally on **both** mapped and prism plots
Field width: 3 digits
Values: 001-360

ITEM 5050 HORIZONTAL DISTANCE

If a tree is on both the mapped and prism plots, then record the horizontal distance from the subplot center for trees 5.0 inches DBH or larger, or from the off-set microplot center for saplings, to the pith of the tree at the base. Record the distance to the nearest one-tenth foot. In the Tree Notes item, record the distance from the prism point to the center of the base of the tree, **only** on prism plot trees that are missed or through growth trees, or if the past distance is off by more than 5 feet, for check cruise purposes. Otherwise dash this item for a tree that is only on the prism plot.

When collected: Remeasurement tally on **both** mapped and prism plots
Field width: 3 digits
Values: 000-999

ITEM R509 PRISM TREE STATUS

Record a PRISM TREE STATUS for each prism point tree; this code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change.

Note: For any prism point tree that is now on the new mapped plot, crews must collect new azimuth and distance information from the subplot center (for trees) or the off-set microplot center (for saplings).

When Collected: All previously tallied trees, through growth trees, and missed trees
Field width: 1 digit
Values:

0 No status –- tree is not presently in the sample. Tree was incorrectly tallied at the previous survey or currently is not tallied due to definition or procedural change.

1 Live tree – any live tree on accessible forest land (remeasured, through growth, or missed)

2 Dead tree -- any dead tree (remeasured, through growth, or missed), regardless of cause of death, which does not qualify as a removal.

3 Removal - a prism tree that has been removed from forestland. Includes any prism tree cut or killed by direct human activity related to harvesting, silcviculture or land clearing. The tree may, or may not, have been used. Only code trees killed by fire as removals if it was a prescribed burn. Also includes live remeasured prism trees that are in a nonforest area.

4 Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc. (remeasurement plots only).

ITEM 5061 NEW TREE RECONCILE (CORE 5.6.1)

Record a NEW TREE RECONCILE for new tally trees on the prism plot that were less than 1.0 inch on the previous inventory and now are 5.0 inches or greater, or for any tree that was missed on the last inventory. Be wary of recording missed trees. Unless it is obvious that the previous cruiser was in error, give the benefit of the doubt.

When Collected: On SAMPLE KIND 9; all missed live tally trees = 1.0 inch DBH and through growth tally trees.
Field width: 1 digit
Values:

2 Through growth – new tally tree 5 inches DBH and larger, within the **remeasured** 6.8-ft radius microplot.

3 Missed live – a live tree missed at previous inventory and that is live, dead or removed now. Also use this code to account for trees that were not tallied at the previous inventory, but are now due to any procedural changes (DBH rule changes, forking rule changes, etc.)

ITEM 5080 SPECIES

Record the appropriate SPECIES code from the list in Appendix 3. If you encounter a species not listed in Appendix 3 and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use code 299 for unknown dead conifers and 999 for unknown dead hardwood when the generic or species codes cannot be used. The generic code (e.g., 400, 540) should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. In this case use the sample collections procedures described above.

When collected: All remeasurement tally
Field width: 3 digits
Values: See Appendix 3

ITEM 5092 CURRENT DIAMETER AT BREAST HEIGHT (DBH) (CORE 5.09.2)

Unless one of the special situations described in Appendix 3 is encountered, measure DBH at 4.5 ft above the ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For example, a reading of 3.68 inches is recorded as 3.6 inches.

When Collected: All live tally trees $\geq$ 1.0 in DBH (TREE STATUS 1)
Field width: 3 digits (xx.y)
Values: 010 to 999

ITEM 5091 PREVIOUS DIAMETER AT BREAST HEIGHT (CORE 5.09.1)

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory onto the data recorder and/or on hardcopy.

When collected: All remeasurement tally trees
Field width: 3 digits (xx.y)
Values: 010 to 999

ITEM 5100 DIAMETER CHECK (CORE 5.10)

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses. Use code 2 for remeasurement trees only.

Note: If both codes 1 and 2 apply, use code 2.

When Collected: All live (TREE STATUS 1) tally trees $\geq$ 1.0 in DBH
Field width: 1 digit
Values:

0	Diameter measured accurately
1	Diameter estimated, or tree shrunk due to bark slough by less than 0.2 inch

2	Diameter measured at different location than previous measurement; the previous diameter was estimated and the current diameter is measured accurately; previous diameter is obviously incorrect; or the tree shrunk by 0.2 inch or more

ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.23)

For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual height from the ground, to the nearest 0.1 in, at which the diameter was measured for each tally tree, 1.0 in DBH and larger.

When Collected: All live (TREE STATUS 1) and dead tally trees ≥ 1.0 in
Field width: 3 digits (xx.y)
Values: 001 – 150

ITEM R503 TREE CLASS

Record the code that indicates the tree class. All palmetto species are coded TREE CLASS 3.

When Collected: All live tally trees ≥ 1.0 in DBH (TREE STATUS 1), all mortality trees ≥ 5.0 in DBH
Field width: 1 digit
Values:

2	Growing stock
3	Rough cull
4	Rotten cull

ITEM 5110 PERCENT ROTTEN/MISSING CULL (CORE 5.11)

Record the percentage of rotten and missing cubic-foot cull volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length. See Appendix 3 for complete procedures and cubic foot volume table.

When Collected: All live tally trees (TREE STATUS 1) ≥ 5.0 in DBH, all mortality trees ≥ 5.0 in DBH
Field width: 2 digits
Values: 00 to 99

ITEM 5120 TOTAL LENGTH (CORE 5.12)

Record the TOTAL LENGTH of the tree, to the nearest 1.0 ft from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees, measure the tallest stem.

When Collected: All live tally trees (TREE STATUS 1) ≥ 1.0 in DBH
Field width: 3 digits
Values: 005 to 400

ITEM 5130 ACTUAL LENGTH (CORE 5.13)

For trees with broken or missing tops. Record the ACTUAL LENGTH of the tree to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. If the top is intact, this item may be omitted on live trees. Forked trees should be treated the same as unforked trees, measure the tallest stem. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk).

When Collected: All live tally trees (TREE STATUS 1) ≥ 1.0 in DBH
Field width: 3 digits
Values: 005 to 400

ITEM 5140 LENGTH METHOD (CORE 5.14)

Record the code that indicates the method used to determine tree lengths.

When Collected: All live tally trees (TREE STATUS 1) ≥ 1.0 in DBH
Field width: 1 digit
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape)

2 Total length is visually estimated, actual length is measured with an instrument

3 Total and actual lengths are visually estimated

ITEM 5190 CAUSE OF DEATH (CORE 5.19)

Record a cause of death for all trees that have died, been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

When Collected: All PAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 - 3
Field width: 2 digits
Values:

10	Insect	80	Human
20	Disease	81	Landcleared – alive (prism trees ONLY)
30	Fire		
40	Animal	82	Landcleared – dead (prism trees ONLY)
50	Weather		
60	Vegetation (suppression, competition, vines/kudzu)	83	Lancleared - cut (prism trees ONLY)
70	Unknown/not sure/other	90	Physical (hit by falling tree)

ITEM 5200 MORTALITY YEAR (CORE 5.20)

Record the estimated year that remeasured trees died or were cut. For each remeasured tree that has died or been cut since the previous inventory, record the 4-digit year in which the tree died. Mortality year is also recorded for trees on land that has been converted to a nonforest land use, if it can be determined that a tree died before the land was converted.

When Collected: All PAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 - 3
Field width: 4 digits
Values: 19xx or higher

ITEM 5220 UTILIZATION CLASS (CORE 5.22)

Record the code to identify cut trees that have been removed from the site.

When Collected: All TREE STATUS = 3 or TREE STATUS = 2 and tree has been cut (salvaged mortality)
Field width: 2 digits
Values:

00 Not utilized - can still be found on the site, or, if not actually found on the site, the cruiser estimates that due to past DBH, species, or from other information, that the tree was not removed from the site for use as a product, either commercially or non-commercially.

11 Commercial utilization – some portion of the tree removed for commercial purposes. Commercial uses include sawlogs, pulpwood, veneer logs, poles, and other products such as firewood cut by commercial firewood operations.

12 Non-commercial utilization – some portion of the tree removed for non-commercial purposes. Non-commercial uses include domestic firewood use, barn poles, fence posts, domestic landscaping, rough slabs, etc.

Trees that have been cut above 4.5 ft (“jump-butt”) due to a fence or defect, are tallied if still standing at 4.5 ft. If the tree is still alive at DBH, then record TREE STATUS = 1 and then record UTILIZATION = 11 or 12. If it is dead at DBH, then record PRISM TREE STATUS = 3 and UTILIZATION = 11 or 12. However, this does NOT apply to naturally swell butted trees where it is normal to cut above 4.5’. Continue to code those trees as removals (TREE STATUS 3) if cut below the diameter point and then code UTILIZATION = 11 or 12.

ITEM 5260 TREE NOTES (CORE 5.26)

Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All live and dead tally trees
Field width: Alphanumeric character field
Values: English language words, phrases and numbers

REVIEW OF FIELD SAMPLING IN PREVIOUS SOUTHEASTERN RESEARCH STATION INVENTORY (FL, NC)

This section is an overview of the previous prism plot design installed by the former Southeastern Station.

SAMPLE LOCATIONS

Sample locations were located randomly on aerial photography. One forest plot location was a cluster of 5 points.

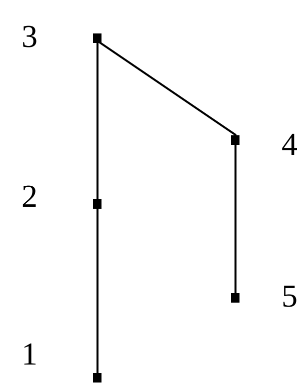
At each location determined to meet the definitions for forestland, five points were sampled using a 37.5 basal area factor to sample live trees 5.0 inches diameter at breast height (DBH) and larger. Additionally, all live trees 1.0 through 4.9 inches DBH within a 6.8 ft radius plot were measured at each sample point.

PLOT LAYOUT

The standard plot layout was:

5-POINT CLUSTER DESIGN

Azimuth and	Distance	from Point	to Point
000	70 ft	1	2
000	70 ft	2	3
120	70 ft	3	4
180	70 ft	4	5

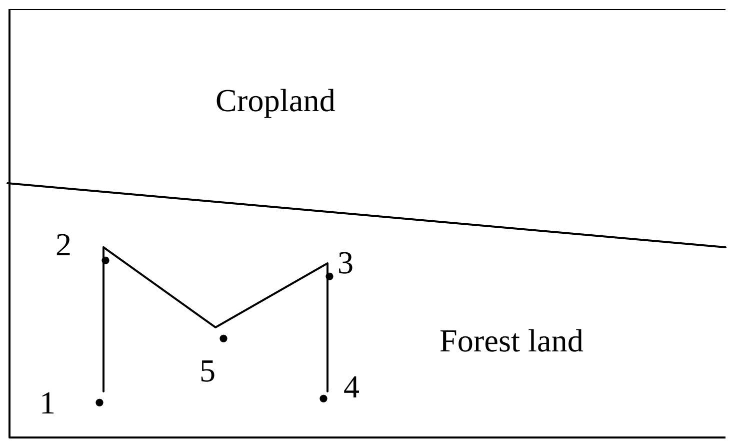


All points were marked with a wire pin. Two witness trees were marked with aluminum tags and scribed with a “T” at point one. One witness tree may be scribed with a double slash (“\\”). Instructions for plot recovery were recorded on the back of the old tally sheets. These instructions included a description of the starting point, and the azimuth and distance from the starting point (SP) to plot center (PC), at point 1. All azimuths were measured from magnetic north.

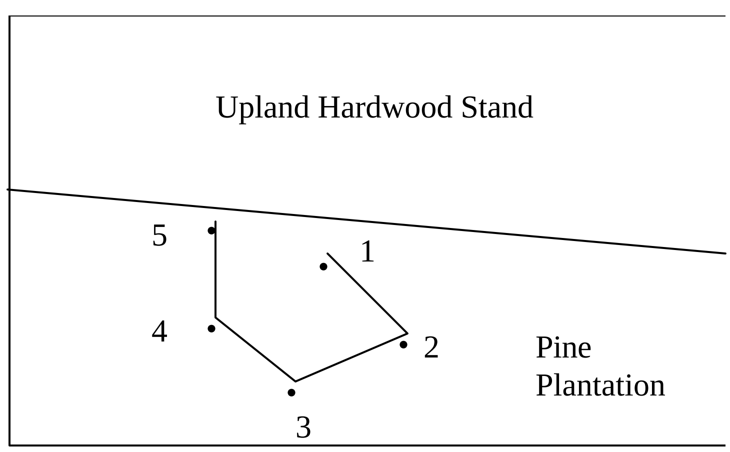
SAMPLING ONE CONDITION

Where point 1, or plot center sampled a forestland use, all points were confined to a single forest condition within forestland. The distinct characteristics that existed on point 1, or plot center, served as the basis for installing the remaining points in the same land use or forest condition. If point 1, or plot center, sampled an area that was defined as a non-forest land use, then the entire plot was classified as non-forest land and no other points were installed. A procedure was used to rotate points in an unbiased manner for those points where point 1 was classified as forestland. If points were rotated, it will be indicated in the diagram section on the previous inventory plot sheet.

Illustrations of different situations that will commonly be encountered:

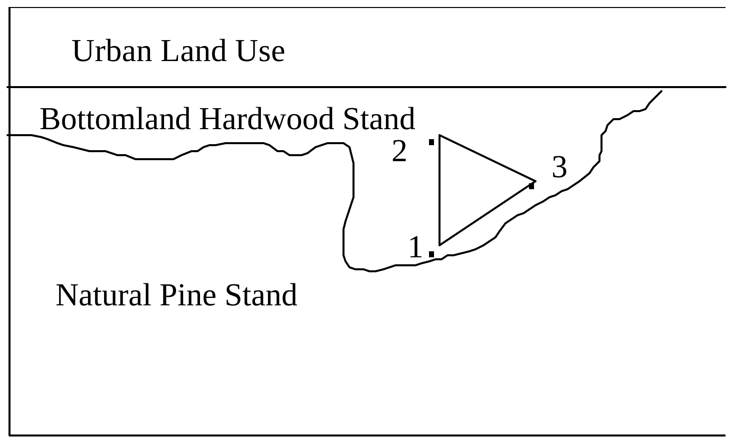


Example 1: Point 1 sampled an area defined as forestland. Points 3 and 4 were rotated into the forestland.



Example 2: Point 1 sampled an area defined as forestland and also sampled a pine plantation. Points 2-5 were rotated from the standard layout so that they fell entirely within the pine plantation.

In certain situations, less than 5 inventory points were installed. If all 5 points could not be installed within a single forest condition using the standard substitution procedure, then the sample was modified by installing as many points as possible. A minimum of 3 points could be established. Example 3 is a situation where less than 5 points were installed.



Example 3: Inventory points were also rotated if the point fell less than 15 feet from an adjacent forest condition or land use. Points were also rotated if a tree was tallied from an adjacent forest condition. In some cases, because of errors made by previous field crews, the points may not be in the exact location. The distance between points may be wrong, the azimuth between points may be wrong, or the diagram on the previous tally sheet may be wrong. Every attempt should be made to locate the previous inventory point.

SUPPLEMENT D

DATA RECORDER INSTRUCTIONS

Installation of National Manual Tally Program (NaTally)

The NaTally program can be installed using either a cd or zip disk, or it can be downloaded form the following website:

http://www.srs.fs.fed.us/fia/data_acquisition/dr/dr.htm

This file is a self-extracting zip file. Download instructions (including how to extract the program files) are found on the web site.

When installing the files, the program will check for necessary disk space (approximately 15 mb). To begin the installation, go to **Step 1** and follow the instructions.

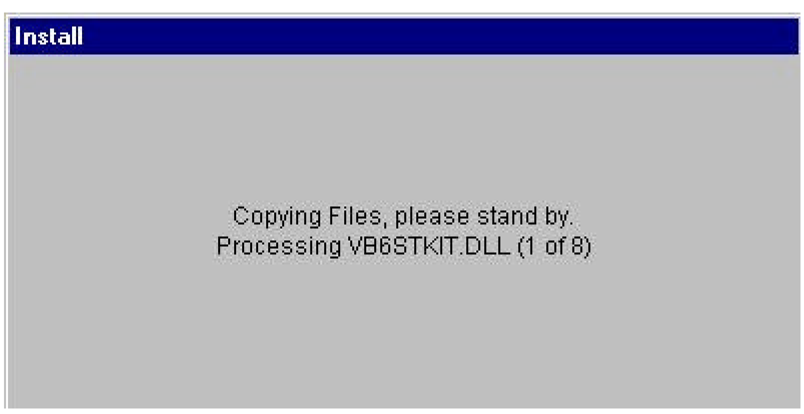
Step 1: After booting the computer or PDR, insert the Zip disk or cd that contains the NaTally installation file. (If you downloaded the installation program, navigate to the folder where it was saved)

Step 2: Start Windows Explorer (or 'My Computer') and open the drive or folder.

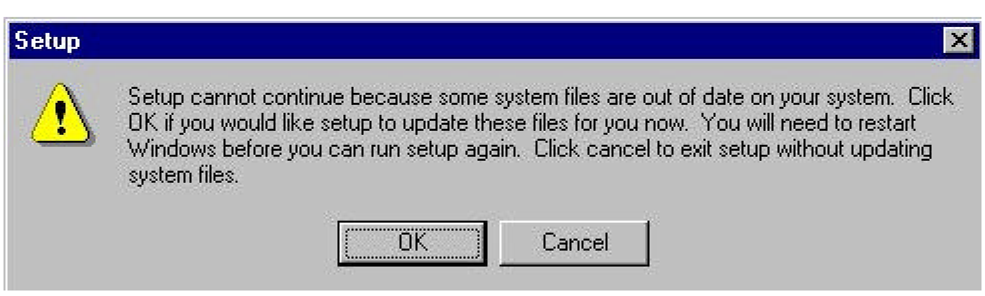
Step 3: Double click or tap the Setup.Exe icon/file

Step 4: Wait while setup files load.

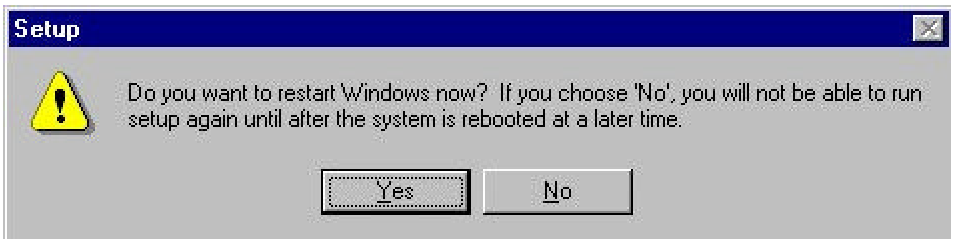
The following screen is displayed as the files are loading:



NOTE: If your computer needs to have files updated for the installation to work, the following screen will be displayed:



To proceed, click the OK button. After the system files are updated, the following screen will be displayed:

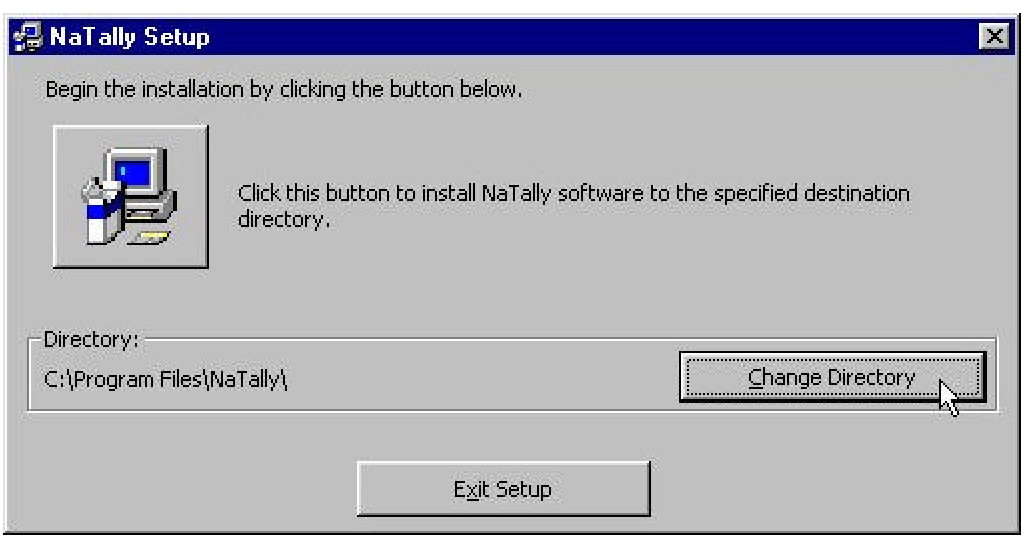


To proceed, click the Yes button. The computer will then automatically restart. After it finishes booting again, go back to **Step 1** and start the installation process over.

Step 5: After the setup tools have been loaded, the following setup screen displays:

To proceed, click the OK button.

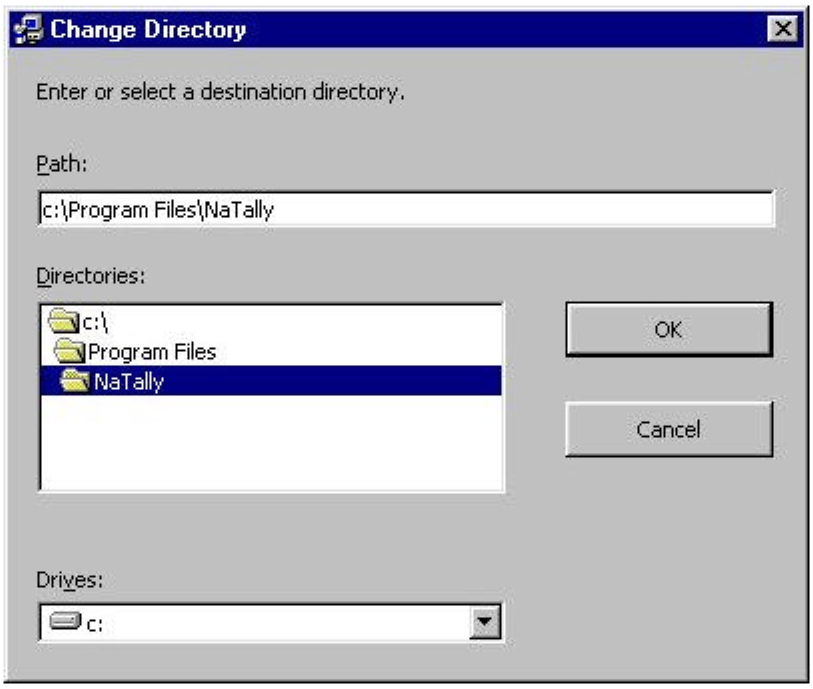
Step 6: The following screen displays after the OK button is clicked or tapped:



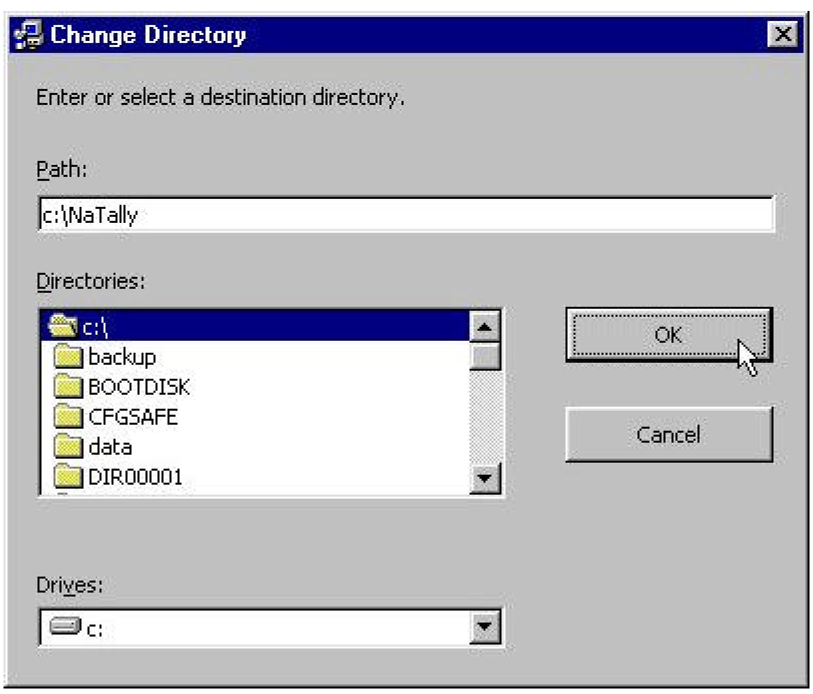
Very Important: the directory showing in the above screen **MUST BE CHANGED** in order for the software to operate correctly. The C:\Program Files\NaTally\ must be changed to C:\NaTally **Before** the install button is clicked or tapped.

To change the directory, click or tap on the Change Directory button in the above screen.

The following screen displays after the Change Directory button is clicked or tapped:

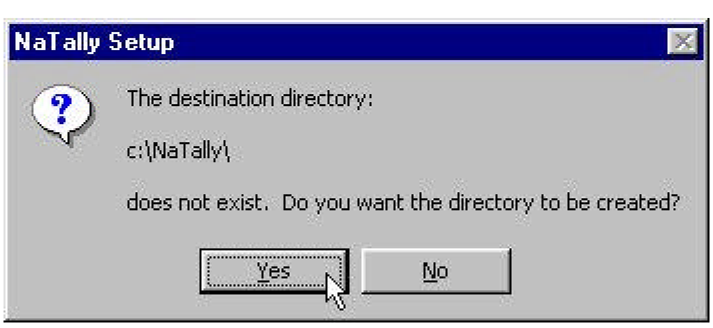


Step 7: Type in the directory c:\NaTally as is displayed in the screen below.



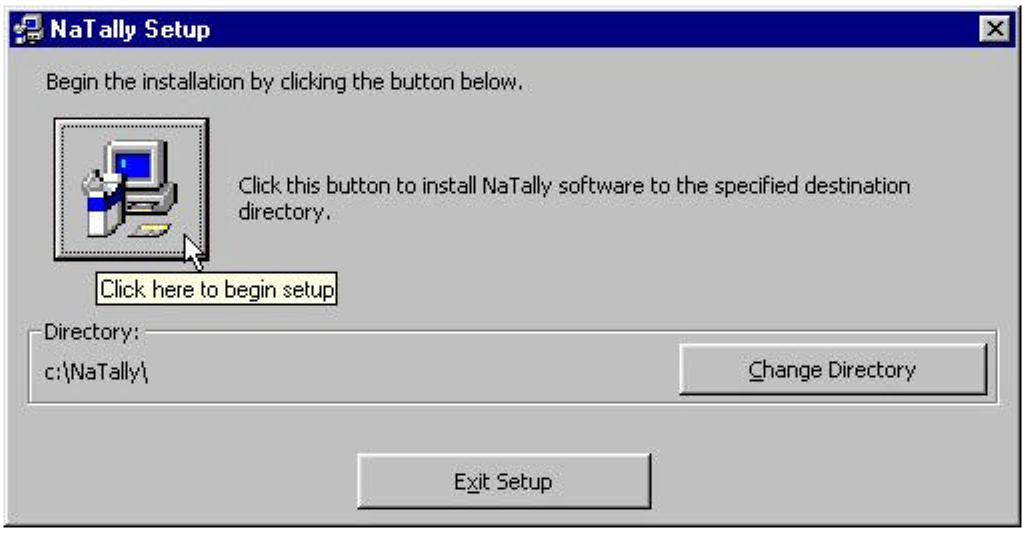
Click or tap the Ok button after the directory has been changed.

Step 8: If a previous copy of NaTally was not installed to the computer, the following window is displayed:



Click or tap the Yes button to create the directory.

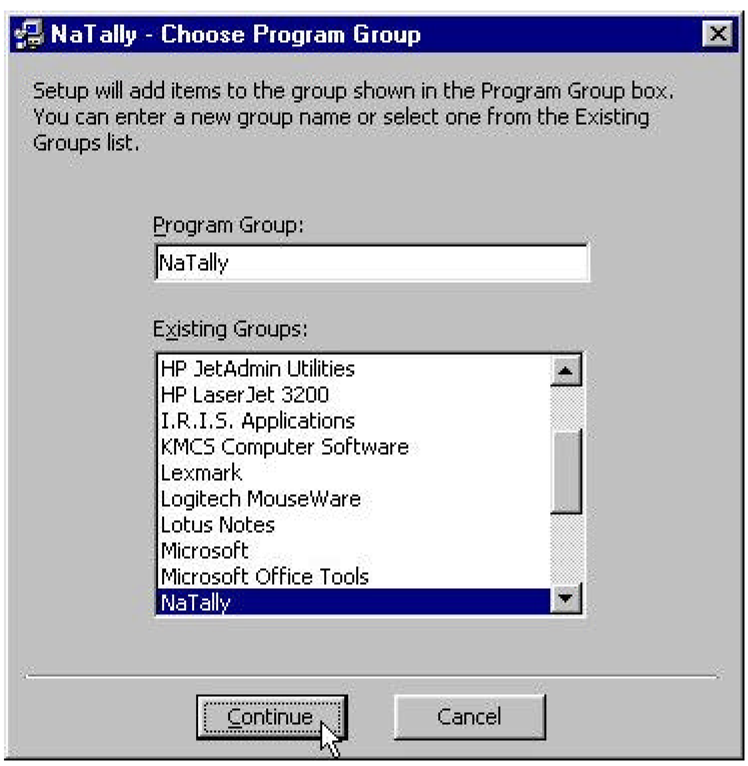
Step 9: The installation process displays the following screen:



Notice that the directory for installation of the software is now correct.

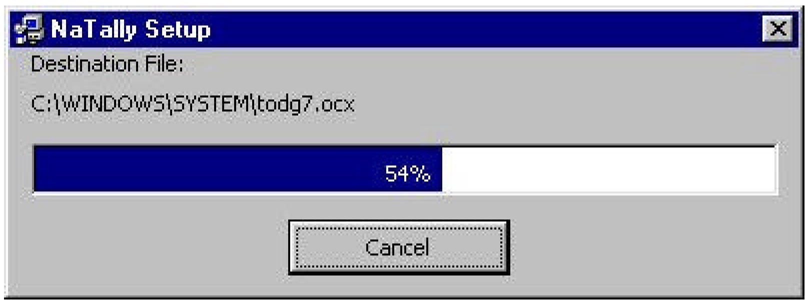
Click or tap the install button to continue the installation process.

Step 10: After clicking the install button, the following screen is displayed.

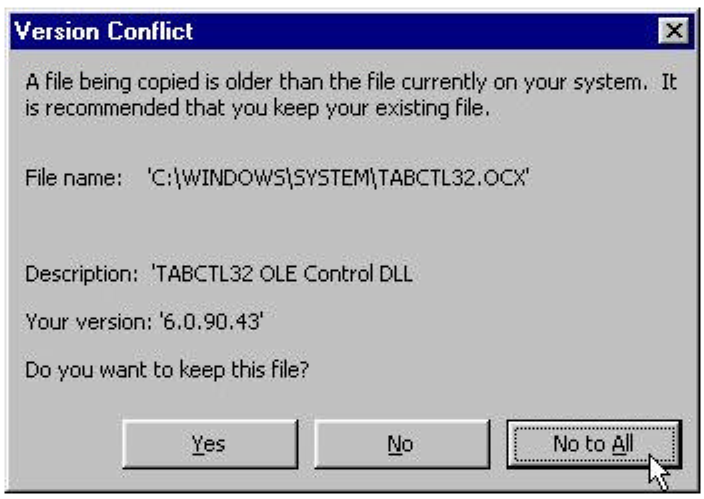


To proceed, click the Continue button.

Step 11: After the continue button is clicked or tapped the installation process continues and the following progress screen is displayed:



Note: You may receive the following ‘Version Conflict’ message (or another similar message with a different file name):



You do NOT want to keep the existing files on your computer, so click on the No to All button to proceed.

Note: If any of the following windows are displayed stating an access violation occurred while trying to copy a file, click on the Ignore button, and then click the Yes button on the subsequent message.

Step 12: If the following message is displayed, or any very similar message regarding a file failing to register, click the Ignore button.

Step 13: When the following message is displayed, click the OK button, and the installation of NaTally will be completed. **Note:** It is useful to create a shortcut on your desktop for 'c:\NaTally\NaTally.

SUPPLEMENT G

GPS INSTRUCTIONS

INTRODUCTION

It has become necessary for the Forest Inventory and Analysis (FIA) crews to collect precise position coordinates of inventory sample plot centers. The purposes are 1) to allow FIA data to be accurately incorporated into GIS applications and other data bases and 2) to enhance plot recovery.

The purpose of this manual is to provide the operator with a brief history of the technology and with the procedures used by FIA crews to obtain position coordinates, calculate a coordinate, navigate to a coordinate, and other field applications.

THE GLOBAL POSITIONING SYSTEM

The concept for a Global Positioning System (GPS) dates back to the early days of space exploration. U.S. scientists tracking the Soviet Union's Sputnik satellite in the 1950s used the dobbler effect of the satellite's radio beacon to determine its orbit. They realized that they could use the same process to determine a position on the earth. Development of the system began in 1973. The first satellites were launched in 1978. Today's system utilizes accurate clocks and measures the time required for a radio signal to travel between the satellite and receiver.

Previously, collecting accurate positions was limited because of the bulk and inconvenience of GPS receivers. These early versions had low accuracy and could not obtain a position fix in real time. Recent developments have provided a methodology capable of accurate position estimates (± 12 meters) in a small, handheld, lightweight receiver. With the aid of a base station, accuracies of less than 0.5 centimeter are obtainable.

The Global Positioning System is a space-based radio positioning system designed to provide suitably equipped users with highly accurate positioning, velocity, and time data. It is comprised of three segments:

> The space segment consists of a constellation of GPS satellites in orbit around the earth. There are 21 operational satellites. There are three or four operational satellites in each of the six orbital planes. Additionally, there are up to three spare satellites. The satellites orbit the earth twice each day at an altitude of 10,900 miles.
>
> The control segment is comprised of a Master Control Station (MCS) and a number of monitoring stations located around the world. The MCS tracks, monitors, and manages the satellite constellation. It also updates the navigation data messages transmitted by the satellites.
>
> The user segment consists of a variety of radio navigation receivers designed to receive, decode, and process the GPS satellite signals.

The system is managed by the Department of Defense (DOD). To prevent enemy forces from utilizing our GPS system, an intentional error is introduced, Selective Availability (SA). SA is the largest source of error within the system. SA induces up to a 100-meter error into any position estimate. To overcome SA, military GPS units have a special chip with a decoding "key" installed that removes the SA. Recently, the U.S.

Department of Agriculture (USDA) and the U.S. Department of the Interior (USDI) have been granted authority to purchase GPS receivers with this chip. There are two models available to these agencies: the Trimble Centurion and the Rockwell Precise Lightweight GPS Receiver (PLGR). Receivers equipped with the decoding chip are revered to as Precise Positioning Service (PPS).

In May 2000, SA was deactivated by the DOD. All GPS units have the same $\pm$ 12 meter accuracy. The DOD has, however, reserved the right to activate SA whenever national security dictates.

SECURITY

PPS receivers because of the security module installed within them are very sensitive security items. As an operator of these receivers, you are assuming a great responsibility, one far and above that of just having signed for another piece of expensive equipment. The security and accountability of your receiver must be your first priority. **Any incident or violation of the restrictions will immediately involve the National Security Agency (NSA) and the FBI.** If they determine that the incident may have compromised key security, the Department of Defense can press for criminal prosecution. They are serious about this. A compromise of the “key” code within your receiver could cause the changing of all keys world-wide, a very expensive and disruptive procedure.

The use of this receiver is authorized by Memorandum of Understanding (MOU) between the Department of Defense and the Department of Agriculture. The continued use of this receiver and the Precise Positioning Service is at the sole discretion of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence.

Pursuant to the MOU, the Federal Radionavigation Plan, and current guidance from the National Security Agency and the Department of Defense Space Command, **the use of PPS receivers is limited to permanent or temporary Federal employees, who are U.S. citizens, or state government employees who are U.S. citizens and are under the supervision of Federal employees.** The use of PPS receivers by others than those mentioned above is currently considered detrimental to security.

The internal security module and cryptographic keys remain the property of the National Security Agency. As such, PPS receivers must be returned to the Agency GPS-PPS Coordinator in a timely manner, upon demand. Requests for return of equipment may also come from the Federal GPS-PPS Coordinator or the controlling authority at Space Command. However, you should never surrender any PPS receiver without first checking with the Agency GPS-PPS Coordinator.

The PPS receiver is considered unclassified by the DOD. However, the receiver contains cryptographic logic which makes the receiver a DOD “High Value Item”. **As such, any loss, theft, tampering, or destruction of a receiver must be reported by the custodian to the Agency GPS-PPS Coordinator immediately.** Serious infractions which may constitute sabotage, loss through negligence, theft, or espionage are punishable under various sections of the United States Code.

The custodian is responsible for all property accounting, including prompt response to the annual inventory by the Federal GPS-PPS Coordinator. The receiver cannot be processed as excess property. The receiver must be returned to the Agency GPS-PPS Coordinator for proper disposal.

When not in use, PPS receivers should be kept in a secure location such as a locked drawer, cabinet, or storage space. Receivers should never be stored in vehicles.

Shipping of PPS receivers must be via traceable mail such as FedEx, UPS, etc.

PPS equipment cannot be shipped or hand-carried outside of the United States (encrypted or not encrypted), without prior approval from the controlling authority at DOD. Outside of the United States is considered to be any other place besides the conterminous United States, Alaska, and Hawaii. The Agency GPS-PPS Coordinator must be contacted prior to any shipping or carrying of PPS receivers outside of the United States, as defined.

When traveling, receivers should be carried in carry-on luggage rather than checked luggage on commercial transport. That carry-on luggage should be in your possession at all times. The receiver cannot be inspected or handled by anyone out of your sight. Do not leave a receiver in plain sight in a locked vehicle. Do not leave a receiver in an unlocked vehicle.

All Forest Service receivers must have a property tag attached. Compliance will be checked each time the unit is sent in to be rekeyed.

THE ROCKWELL PLGR

FIA has chosen to purchase the Rockwell PLGR (pronounced “plugger”). One of the reasons for its selection was its ability to obtain a position fix under a forest canopy. The PLGR is capable of far more than simply calculating the desired position and elevation. Cruisers quickly learned it can be used to navigate to the plot, determine the course to plot, obtain a photo reference azimuth, and determine areas.

REPORTABLE INCIDENTS

If any of the following incidents happens to the PLGR, **report it immediately to the SRS GPS Coordinator or to the Missoula Technology and Development Center (MTDC):**

1. **Lost receiver**: Know where your receiver is at all times. If you lend it to someone, keep that information in a notebook.
2. **Stolen receiver**: Keep your receiver locked-up, even in the office.
3. **Appears to have been tampered with**: Do not attempt to repair or for any other reason attempt to get into the receiver case. NSA will consider that a possible compromise of the code module.

4. **Damaged**. Regardless of the extent, a damaged unit must be returned to MTDC.

If loss or damage to the unit is determined to be the result of negligence, you will be held financially responsible in addition to facing possible criminal charges.

Do not place the PLGR or other equipment on the top of your vehicle after completing a plot. Too many PLGRs and data recorders have been lost or damaged when the driver pulls away.

For future reference:

SRS GPS Coordinator:

Bobby L. Morris
Southern Research Station
200 Weaver Blvd.
Asheville, NC 28804
Phone: 828-257-4366
Fax: 828-257-4894
Pager: 1-800-333-2337, then enter 555-0228 when prompted
E-Mail: blmorris@fs.fed.us

National GPS Coordinator:

Bill Kilroy
USDA Forest Service -- MTDC
5785 Highway 10 West
Missoula, MT 59808
Phone: 406-329-3925
E-Mail: bkilroy@fs.fed.us

In addition to the property tag mentioned earlier, all SRS FIA PLGRs must have a tag instructing the finder to call 828-257-4350.

When transferring a PLGR to another person, an Acknowledgement of Receipt of PLGR GPS Unit must be completed by the receiving party and sent to the SRS GPS Coordinator. An example of this form appears at the end of this manual.

COSTS

This technology does not come cheap:

Item	Cost ($)
PLGR	2000
NiCad Battery	56
NiCad Charging Station	281
12v. Cell Phone Battery	35
3.6v. Memory Battery	5
External Antenna	188
External Antenna Cable	75
External Power Cable	26
AC/DC Power Adapter	30

CRYPTOGRAPHIC KEY

The PLGR will need to be keyed annually by the MTDC. This usually occurs during the last quarter of the calendar year. With overnight shipping, this procedure will require three business days. Therefore, cruisers need to schedule their work so as to have the use of another PLGR while theirs is being rekeyed, or be prepared to return to plots to obtain coordinates when the PLGR has been returned.

SHIPPING

The PLGR must be shipped via traceable mail. Because of the excellent service and corporate account, SRS prefers to use FedEx. The account number will be provided when required.

When shipping the PLGR to MTDC for rekeying, include a paid, return shipping label.

POWER MANAGEMENT

The PLGR requires 12 volts to operate. External power sources must be between 12 and 32 volts DC. For field operations, there are three power source options:

AA battery pack: Utilizes eight AA batteries. Cruisers report the AA batteries will power the unit for about four hours, sometimes more, usually less. The short life expectancy and cost of AA batteries makes this an expensive option.

Rechargeable NiCad battery: A good NiCad battery is rated for about fours of use. Cruisers report the NiCad battery lasts up to six hours. However, the useful life decreases as the battery develops a memory with age. An external charger is provided with the battery for overnight charging. Connecting an external power source to the PLGR recharges the NiCad battery within 36 hours. The initial cost of the battery and charger make this is a relatively expensive option.

Cell phone battery: This is a 12-volt, lead-acid battery that is used as an external power source. This battery can power the unit for 16 hours easily. The battery requires nine hours to charge. This option is relatively inexpensive and is recommended if the PLGR is used for several hours each day.

Two sources of power should be taken into the field at all times. Most cruisers use either the cell phone battery or the NiCad battery as their primary power source and the AA battery pack as a reserve.

When installing the AA battery pack or the NiCad battery, **do not drop the pack into the battery compartment.** The contacts at the bottom of the compartment can be broken. Gently slide the battery into the compartment.

The PLGR also uses a 3.6-volt lithium battery to maintain the data, setup information and cryptographic key. This battery is similar in size to a AA battery. Don't get them confused. The memory battery is replaced annually. The GPS Coordinator will provide one as needed. Instructions are provided with the replacement battery.

While operating the PLGR, you may receive one or more power warning messages:

Low Primary Power: Your AA/NiCad battery is low. Replace the battery.

Lost External Power: You have lost external power. This is most likely the result of a loose connection or low external battery power. However, a frayed power cord or a blown fuse in the external power cord is also a possibility.

Low Memory Battery: The memory battery is low. Replace the memory battery.

It is recommended that you maintain a fresh primary battery, whether for overnight or extended storage. The PLGR will attempt to operate using the memory battery if there is no other power source. The unit will begin the startup cycle when turned ON. But after a few seconds the screen goes blank. **Do not continue pressing the "ON" button when this occurs.** Continued attempts to turn the unit ON will drain the memory battery. You risk losing the key and any stored data.

You may monitor your battery's performance on the Battery Status Page.

1. Press MENU, STATUS will be blinking
2. Press the Down-arrow. The bottom line of the first STATUS page displays the source of power: Battery or Vehicle
3. Press the Down-arrow. The Battery Status page is now displayed.
4. The first line displays the type of battery installed. You will need to change this if the type battery installed is not correctly displayed. If a NiCad battery is installed, the PLGR will automatically sense it and display: "NiCad". If you are using a AA-pack, you will need to tell the PLGR the type of battery being used. Press the right-arrow. Use the up-/down-arrow to scroll between the battery options: AA-Alk, BA-5800, and AA-Lith.
5. The third line displays the elapsed time the battery has been used.
6. If you have just installed a fresh battery, you will want to reset (RST) the time used. Press the left-/right-arrow until RST is blinking. Pressing the up-/down-arrow will reset the time used to zero.
7. The fourth line displays the calculated time left on the battery. This figure is notoriously overly optimistic.

MAINTENANCE AND TESTING

With the exception of replacing batteries, the PLGR requires little maintenance. Inspect the gasket inside the battery cover for damage and dirt. Clean if necessary.

The PLGR has two tests:

The self-test is run every time the unit is turned ON. The self-test results can be seen by pressing the MENU key and selecting STATUS. If the self-test failed, press the up-arrow key to see the self-test failure page. See paragraph 2.7.1 of the Operations and Maintenance Manual for self-test messages.

A second, more comprehensive test is run at the command of the operator. Press the MENU key and select TEST. This test requires several minutes to complete. During this time, the PLGR cannot perform any navigation functions or provide any position coordinates.

Do not attempt to repair a malfunctioning PLGR. Return it to your GPS Coordinator.

OPERATION

There are two iron-clad rules for operating the PLGR. If these rules are not complied with, the receiver will be disabled.

Do not press the "CLR/MARK" and the "NUM LOCK" keys simultaneously! This will erase (zeroize) all stored data and destroy the key. This feature was incorporated for use by the military. In the event of imminent capture, soldiers can prevent the enemy from using the technology against us.

Do not remove the memory battery plug on the bottom of the unit! Removing the battery plug will disconnect the memory battery. It will zeroize the unit if there is no other power source. When replacing this battery, the unit must be connected to an outside power source.

You can easily determine if the PLGR is keyed. On the second page of MENU options, "CRYPTO" should be displayed in the lower left-hand corner. If it is not displayed, then the unit is no longer keyed and must be returned to MTDC for rekeying.

KEYPAD

Left/Right-Arrow Keys

The Left-arrow (←) and Right-arrow (→) keys move the cursor from field to field in the display. Press the right-arrow key, and the cursor moves right across the display. It then moves down to the next line as if the display were a single line. As the last field on the bottom is reached, the cursor wraps to the first selectable field on the top of the display. Pressing the left-arrow key causes the cursor to move to the left, then up to the previous display line.

Up-/Down-Arrow Keys

The Up-arrow (▲) and Down-arrow (▼) keys are used to change display pages, change number/alpha field values, and activate functions. The operation performed depends on what field is selected when the keys are depressed

When the cursor is on an option field, pressing the up-/down-arrow key scrolls through the options.

When the cursor is on a changeable value field, pressing the up-/down-arrow keys increases or decreases the field to the next higher/lower available value. When held, the key causes scrolling to speed up.

When the cursor is on the paging (P) field in the lower right-hand corner of the display, pressing the up-/down-arrow keys scrolls to additional pages.

MENU Key

The MENU key displays the system menu pages. The menu consists of display pages that allow you to monitor PLGR operation and control operating functions and interfaces with other equipment

WP Key

Pressing the WP key brings up the waypoint menu display. The waypoint functions allow you to manage waypoint data, calculate coordinates of a waypoint, and determine routes and distance data from one waypoint to another.

POS Key

Pressing the POS key brings up the position display. The position display pages display current position, time, speed, satellite tracking status, current datum, magnetic variation, operator identification, and bullseye position. Pressing the POS key while in another display displays the last-used position page.

Pressing and holding the POS key for approximately five seconds causes the operating mode to toggle between averaging and continuous tracking modes.

NAV Key

Pressing the NAV key brings up the navigation information displays. The first page selects the display mode, navigation method, and destination waypoint. More pages are available to display the various waypoint navigation information. Pressing the NAV key while in another display displays the last-used navigation page.

MARK Key

The MARK key is used to activate the MARK (marking present position) and Man Overboard (MOB) waypoint selection page. On this page, the first unused waypoint is automatically selected for storage. The waypoint may be changed to any waypoint number and can be used with either MARK or MOB selection.

NUM LOCK Key

Pressing the NUM LOCK key toggles the keypad between control mode and numeric mode. An N is displayed at the lower right of the display in the numeric mode.

0 thru 9 Keys

In the numeric mode, pressing a 0 thru 9 enters its numeric value into the selected field. If a nonnumeric field is selected, keypad operation is the same as described for the control mode.

CLR Key

The CLR key moves the cursor to the left. This allows wrong entries to be reentered.

PLGR SETUP

The first time you use the PLGR and after rekeying, you'll need to set several parameters. These parameters make the information specific to your location and needs. Once these values are set, they become the default values.

1. Turn the unit on. The PLGR goes through a self-test routine for a few seconds, briefly displays the battery status, and then displays the Position screen.
2. Press the MENU key. STATUS will be blinking.
3. Press the RIGHT-ARROW key. SETUP will be blinking
4. Press the DOWN-ARROW key. The first page of the setup menu is now displayed.
5. Press the LEFT-ARROW key so the field value for SV-TYPE is blinking. Press the DOWN-ARROW so “mixed” is displayed. Press the RIGHT-ARROW. Note the double-arrow beside the “P” in the lower right corner.
6. Press the DOWN-ARROW to move to the next page.
7. Press the RIGHT-ARROW so the field value for SETUP UNITS is blinking. Use the DOWN-ARROW to scroll between the options. Stop when “L/L-dms” is displayed. “L/L-dms” signifies latitude/longitude-degrees, minutes, seconds.
8. Press the RIGHT-ARROW to set the units for Distance and Elevation. Use the DOWN-ARROW to scroll between the options. Stop when “ENGLISH” is displayed.
9. Press the RIGHT-ARROW so the value for Elev is blinking. Use the DOWN-ARROW to toggle to “feet”.

10. Press the RIGHT-ARROW. Use the DOWN-ARROW to toggle to “MSL”.
11. Press the RIGHT-ARROW so the value for ANG is blinking. Scroll through the options until “DEG” is displayed.
12. Press the RIGHT-ARROW. Scroll through the options until “Mag” is displayed. This parameter is used when calculating coordinates. Since our compasses are not set for declination, we want to use magnetic North rather than true or grid North.
13. Press the RIGHT-ARROW and DOWN-ARROW to go to the next page. This is the Magnetic Variation page.
14. Press the RIGHT-ARROW. The value for TYPE should be blinking. Scroll through the options until “Calc” is displayed.
15. Press the RIGHT-ARROW. Scroll through the options until “deg” is displayed.
16. Press the RIGHT-ARROW and DOWN-ARROW to proceed to the next page.
17. Press the RIGHT-ARROW to move to the “WAGE” field. WAGE should be “on”. “WAGE” signifies Wide Area GPS Enhancements. When ON, the PLGR process enhanced clock correction signals from the satellites.
18. Press the RIGHT-ARROW to move to the “ELHold” field. ELHold should be “automatic”.
19. Press the RIGHT-ARROW to move to the “TIME” field. Use the DOWN-ARROW to scroll to the correct time zone correction for your locality:

EST	LOC=Z-0500	EDT	LOC=Z-0400
CST	LOC=Z-0600	CDT	LOC=Z-0500

    This parameter is not critical to PLGR operations. When set correctly, the time displayed on the second Position page will be the correct local time.
20. Move the cursor to the “ERR:” field. Use the DOWN-ARROW to scroll to “EHE” for the two-dimensional error.
21. Press the RIGHT-ARROW and DOWN-ARROW to move to the next page.
22. Press the RIGHT-ARROW and scroll through the options for “DTM:” Stop when “NAR” for North American Datum 1983 is displayed.
23. Press the RIGHT-ARROW to move to the “AUTOMATIC OFF TIMER:”. Scroll to select “20 min”. This function is used to save battery power. It is enabled only when battery power is being used. This function starts when a good solution is obtained and resets every time a keystroke is entered.
24. Press the RIGHT-ARROW.

Your PLGR is now set up and ready to calculate your position. Press the “POS” key.

After the PLGR has run its self-tests and displays the Position screen, the PLGR downloads the daily almanac and verifies the cryptographic key. These processes are automatic and require 12 to 25 minutes. You will get the quickest position lock and most precise solutions with the current almanac. You may get a solution before the almanac has been updated; but it will likely have a higher error estimate. Therefore, it is recommended that you turn the unit on while you are driving to your work area. You can connect the PLGR to the vehicle's electrical system using the external power cord. This will preserve your battery power. Use the external antennae or place the unit on the dashboard (safety permitting) while driving to the work area.

OBTAINING A POSITION FIX

When the PLGR is turned on, the default screen is the Position screen. You need do nothing to get a position fix. You must track four satellites to obtain a position fix. However, if after 20 to 25 minutes you have not obtained a fix, turn the unit OFF and back ON. Sometimes the unit gets hung-up trying to track a satellite. Cycling it OFF and ON forces it to look at other satellites.

Several factors influence satellite reception. Satellite signals can be blocked by terrain, vegetation, and the human body. Although weather is not supposed to effect PLGR operations, cruisers have reported difficulty obtaining a position fix on overcast days. Orienting the PLGR's antennae vertically aids in signal reception.

The tracking mode is displayed in the upper left corner of the screen. The error estimate is displayed in the upper right corner. The Latitude and Longitude are displayed on the second and third lines. Finally, the elevation is displayed in the lower left corner.

The default operating mode for the PLGR is continuous (CONT). "CONT" is displayed in the upper left corner of the first Position screen. In this mode the PLGR continually calculates and displays the current position estimate. Once the PLGR has a fix on the position, you will note that the seconds of latitude and longitude constantly change. If you were to plot these coordinates, you would find that they are clustered around a central location. It is that central location we want to record. To determine that central location, the PLGR can calculate the running average of these coordinates.

There are two methods used to switch from continuous mode to averaging mode.

1. While the first Position screen is displayed, press and hold the POS key for five seconds. This toggles between the two modes. "AVG 00000" will replace "CONT" in the upper left corner of the screen.
2. This second method can be used to improve performance in very low signal environments, such as under dense foliage.
   a) Go to the SETUP menu.
   b) Change the SETUP MODE to "STBY",
   c) Press MENU and return to the Setup menu.
   d) Now change the SETUP MODE to "AVG".
   e) Press the POS key.

   For a brief instant, you will see "STBY" in the upper left corner before it changes to "AVG 00000".

While in averaging mode, **do not move the PLGR.** The PLGR must obtain a valid position fix for 13 seconds before averaging will begin. This may require some time. Solutions will be averaged once per second. The first position screen displays the averaged value and the sample counter. Although there is no established rule for determining the sample number required to ensure an accurate estimate, FIA has selected 180 samples as the minimum required.

The maximum allowable error estimate is ± 70 feet. The PLGR routinely has error estimates in the low-20s. The error estimate is a function of the satellites relationship to the receiver. As the satellites orbit the Earth, this relationship, or geometry, changes. Consequently, the error estimate is constantly changing.

Occasionally, you may want to reset the sample counter. For example, the satellite geometry has changed, and you are now receiving a lower error estimate.

1. Press the left-/right-arrow, and the sample counter will begin to blink.
2. Press the up-/down-arrow key to reset the counter.
3. Pressing the left-/right-arrow key a second time returns the cursor to the paging (P) field in the lower right corner.

On the rare occasion that you cannot obtain a position fix, there are two options. You can try again at a different time of day when the satellite geometry has changed. Or, you can obtain a position fix off the plot center, determine the bearing and distance to the plot center, and use the PLGR's range-calc feature (discussed later).

Once you have the required number of samples, record the error estimate and the number of samples on your form(s) or data recorder. The error estimate and number of samples are not stored electronically in the PLGR. You have the option to record the coordinate on paper or data recorder, or you can save the coordinate in the PLGR's memory for entry onto the data recorder and form(s) at a later time.

SAVING A POSITION FIX

The PLGR can store up to 999 waypoints, 1 – 999.

MARK saves the current position's coordinates. To save a position fix or waypoint (WP), press MARK. The PLGR will automatically assign the first available WP to that position. At this time you may change the WP number, by pressing the NUM LOCK key and entering the desired WP number, or using the up-/down-arrow key to scroll to the desired WP number. Once the desired WP number is displayed, pressing MARK a second time saves the entry. If you used the NUM LOCK feature, remember to press NUM LOCK again to return to the control mode before pressing MARK a second time. If the waypoint you have selected is already assigned, pressing MARK a second time overwrites the previously stored coordinate.

There is no rule for assigning waypoints. However, most cruisers assign the waypoint the same number as the plot number. Other waypoints used in association with that plot receive waypoint number(s) beginning or ending with the plot number. For example, plot 36 would be assigned WP

36. Associated waypoints, such as the SP, would be assigned WP 361, 362, 363,… or 136, 236, 336,….

MANUALLY ENTERING A WAYPOINT

It will be necessary to manually enter a coordinate occasionally. SRS recently adopted a hexagon design for plot locations. If there is an existing plot located in the hexagon, that plot is used to represent the hex. In the event there is no plot in the hex, an empty hex, coordinates will be provided for the new plot's location. These coordinates must be manually entered into the PLGR.

1. Press WP, select ENTER, and press NUM LOCK.
2. Press the right-arrow and enter the desired waypoint number.
3. Pressing the right-arrow once allows you to name the waypoint if you want. Otherwise, press the right-arrow a second time.
4. Press the right-arrow a third time. The PLGR defaults to North latitude. All of our coordinates are North latitude.
5. Enter the degrees, minutes, and seconds north latitude.
6. Press the up-/down-arrow to toggle the longitude to "W". All of our longitudes are West longitude.
7. Press the right-arrow and enter the degrees, minutes, and seconds west longitude.
8. There is no elevation to enter. Press the right-arrow twice.
9. Press the up-/down arrow. You will see "WAYPOINT STORED"
10. Press any control mode key: POS to go to the position screen, NAV to navigate to a waypoint, WP to work with waypoints, etc. To enter additional waypoints, press the down arrow to return to the entry screen (step 2).

CALCULATING A WAYPOINT

On occasion it will be necessary to calculate a waypoint. Rather than occupy a nonforest plot, we will calculate its coordinates. Having found the plot starting point (SP), you may want to calculate the plot center (PC) coordinate and use the PLGR to facilitate finding the plot.

Before you can calculate a waypoint, you must first have a waypoint stored in the PLGR. This waypoint may be a saved (marked) WP or a manually entered waypoint. This will usually be a marked WP that represents the SP. You must also have an azimuth and distance from the stored WP to the PC. This you will obtain from having drawn-up the photo or be provided by the previous crew.

1. Press WP and select RNG-CALC.
2. Use the right-arrow to move the cursor to the first numeric field.
3. Enter the waypoint number for the beginning point.
4. Move the cursor to the RNG field, and enter the distance and units to the desired location.
5. Move the cursor to the AZ field, and enter the azimuth to the desired location.
6. Move the cursor to the paging (P) field in the lower right corner. For our purposes, we do not need to enter an elevation.

7. Press the down-arrow to go to the next page. The calculated coordinate is now displayed. You can record the calculated coordinate on your data recorder or form(s).
8. To save the calculated coordinate as a waypoint:
    a) Press the down arrow to go to the next page. This page is similar to the MARK page. Change the waypoint assignment if you desire.
    b) Press the left-/right arrow key to move the cursor so STORE is blinking.
    c) Pressing the up-/down-arrow while STORE is blinking will save the calculated coordinate as the assigned waypoint.

NAVIGATING TO A WAYPOINT

You will want to use the PLGR to locate a point. This may be the PC of an established plot or a new plot, in the case of an empty hex.

The PLGR has several navigation scenarios pre-programmed. These navigation programs contain a number of parameters that are not needed for our application. Many of these functions require a minimum ground speed (approximately 1.5 kph) before they can be used. Also, the parameters of interest do not appear on one screen. The user must select one page to get the distance and another page to get the azimuth to plot. It is recommended that you enter a custom navigation program.

To enter a custom navigation screen, go to the CUSTOM NAV option in the MENU. You may select any parameter(s) that you feel will be useful. However, there are three parameters that are considered minimal: Waypoint and Error Estimate (WP/EHE), Azimuth to Waypoint (AZ), and Distance to Waypoint (RNG). A fourth parameter 2-Dimensional Steering (STR2d) is useful. After displaying the desired parameter, going to the next line selects that parameter. When you have selected all of the desired parameters, press any function key (MENU, POS, NAV, etc.) to exit and save your custom navigation screen.

1. Press MENU three times.
2. Select CUSTOM NAV.
3. Press the right-arrow and use the up-/down-arrow to scroll through the options until WP/EHE is displayed.
4. Press the right-arrow to go to the next line
5. Select AZ.
6. Press the right-arrow.
7. Select RNG.
8. Go to the next line.
9. Select STR2d.

These four items will be displayed on a single screen. Any other parameters you may choose would be displayed on the second and subsequent screens. Other parameters might include Ground Speed (GS), Slope Range (SR), Tracking (TRK), and Tracking and Ground Speed (TRK/GS),

To navigate to a waypoint, you first must configure the display mode and navigation method.

1. Press NAV.
2. Use the arrow keys to select CUSTOM (if you have defined a custom navigation screen) or SLOW as the display mode. SLOW navigation mode is used when traveling on foot over rough or difficult terrain.
3. Use the arrow keys to select DIRECT as the navigation method. DIRECT is used to navigate from the present position directly to the destination. Other methods require a predefined course or route.
4. Use the arrow keys to move to the second line and select the destination waypoint.
5. Move the cursor to the paging field, and go to the next page.
6. The navigation parameters are displayed on the second and subsequent screens.

You may use the PLGR to establish a plot. In the case of an empty hex, you will be provided with coordinates. Plot the location on your county map to determine the location and the appropriate photo. Use the map and photo to approach the area. Use the PLGR to direct you when you are close. When navigating to the plot, the position mode must be continuous. When you are prepared to set the plot, switch to the averaging mode. Before setting the PC, you must have the minimum 180 samples. Use a compass and tape to close the remaining bearing and distance to the plot.

DETERMINE THE COURSE TO PLOT

This feature is used to determine the bearing and distance from the SP to the PC. For distances less than 500 feet, it is recommended that you use the PDRS traverse program. The PLGR's solution may not be within the quality assurance tolerance level for these shorter distances.
1. Obtain and MARK the coordinates for the SP and PC.
2. Press WP and select DIST.
3. Enter he waypoint that represents the SP.
4. Enter the waypoint that represents the PC.
5. The distance (RNG) and azimuth (AZ) are calculated and displayed.

You may also use the NAV function. This requires either the SP or PC coordinate be marked.
1. Obtain and mark the coordinate for the SP/PC.
2. Obtain the coordinate of the SP/PC.
3. Press the NAV key and enter the waypoint representing the marked SP/PC.
4. Go to the second NAV screen and obtain the distance and azimuth to the destination waypoint. If the marked coordinate is the SP, record the reverse azimuth of the solution.

DETERMINE AREAS

One acre is the minimum size requirement for forest, nonforest, and within forest conditions. Therefore, accurately determining areas is essential. The PLGR calculates areas to the nearest 0.1 acre. If the calculated area is 1.0 acre, you may want to use the DIST function to obtain the azimuth and distances between waypoints and use the PDRS area feature to ensure the area is not 0.95 to 1.0 acres.

1. Obtain and mark coordinates around the perimeter of the area in question. Up to 26 waypoints can be used to define a single route. If you require more than 26 waypoints to define the perimeter, divide the area into two or more parcels.
2. Press WP and select ROUTE
3. Select ENTER
4. The PLGR defaults to the first unassigned route number. Assign a route number and name if desired.
5. Enter the waypoints corresponding to the perimeter.
6. To save the route, either scroll through to the end of the route list and select the SAVE option, or press one of the major function keys (MENU, POS, WP, etc.).
7. After the route has been saved, select the POLY option of the ROUTE menu. This displays the circumference and the area of the defined polygon.

DETERMINE PHOTO REFERENCE AZIMUTH

In hilly/mountainous and undeveloped areas, finding a linear feature that can be used as a reference azimuth is difficult. The PLGR can be used to obtain an azimuth between two identifiable points. However, using the PLGR to obtain a Reference Azimuth should not become an everyday practice.

1. Identify two points on the photo that you will be able to locate on the ground. These points should be widely spaced, further is better.
2. Obtain and mark coordinates of the first point. Because of the scale of the photos, it is not necessary to use averaging mode for this application.
3. Obtain coordinates for the second point.
4. Use the procedures described above to determine the azimuth between the two points.

CLEAR WAYPOINTS

Periodically, you will want to clear stored waypoints.

1. Press WP and select CLEAR.
2. Using the arrow keys, select the range of waypoints you want to delete.
3. Pressing the up-/down-arrow while “ACTIVATE” is blinking will begin the process.
4. The PLGR now needs confirmation that you want to delete the waypoints. If the range is correct, use the arrow buttons to select CONFIRM. If the range is incorrect, select CANCEL to stop the operation.

OTHER USEFULL SCREENS

Information contained on a number of screens will help you monitor the PLGR's performance.

STATUS

Page 1 displays the GPS Status, Self-Test Results, Antenna Source, and Power Source.

Page 2 displays the Battery Type, Recharge Status, Time Battery Used, and Time Battery Left.

Page 4 is the Satellite Tracking Status and shows the signal status of the satellites being tracked. Pressing the left-/right-arrow toggles the first column to display a fifth satellite.

Line 1 displays the number of the satellite (SV) being tracked/searched

Line 2 displays the signal strength (CN). 34 dB is considered nominal.

Line 3 displays the code type (CD) being transmitted by the satellite.

Line 4 displays the satellite status (ST): I=interference, R=recovery, S=search, and T=Track

Page 5 shows the satellite status information:

Line 1 displays the number of the visible satellite (SV).

Line 2 displays the satellite's health: OK or BAD.

Line 3 displays the azimuth to each satellite (AZ).

Line 4 displays the elevation angle of each satellite and whether the satellite is ascending or descending.

POSITION

Page 1 displays the current position information

Page 2 displays the Time, Date, Track, and Ground Speed.

Page 3 displays the satellite usage summary that includes the almanac age.

Page 4 displays the current datum, the magnetic variation, and the operator ID.

ACKNOWLEDGEMENT OF RECEIPT OF PLGR GPS UNIT

UNIT #___________ SERIAL #________________

PROPERTY #________________________________

NAME ____________________________________ STATE______

THIS IS TO ACKNOWLEDGE RECEIPT OF THE ABOVE GPS UNIT. THIS IS ALSO TO ACKNOWLEDGE THAT I BEEN BRIEFED OF THE SECURITY INVOLVED WITH THIS UNIT BEING IN MY POSSESSION.

______________________________________ ________________

(signature) **(date)**

ACKNOWLEDGEMENT OF RECEIPT OF PLGR GPS UNIT

UNIT #___________ SERIAL #________________

PROPERTY #________________________________

NAME ____________________________________ STATE______

THIS IS TO ACKNOWLEDGE RECEIPT OF THE ABOVE GPS UNIT. THIS IS ALSO TO ACKNOWLEDGE THAT I BEEN BRIEFED OF THE SECURITY INVOLVED WITH THIS UNIT BEING IN MY POSSESSION.

______________________________________ ________________

(signature) **(date)**

SUPPLEMENT W

SPECIAL DATA COLLECTION PROCEDURES IN WEST OKLAHOMA AND WEST TEXAS

SPECIAL DATA COLLECTION PROCEDURES IN WEST OKLAHOMA AND WEST TEXAS

This section describes special procedures required when measuring western woodlands in Oklahoma and Texas.

1.0 PLOT LEVEL DATA

No differences in plot level data.

2.0 CONDITION CLASS

The following condition level items and descriptions have special requirements for western woodland forest types:

2.3.1 ACCESSIBLE FOREST LAND
ITEM 2404 STAND SIZE CLASS
ITEM 2410 STAND AGE

2.3.1 ACCESSIBLE FOREST LAND

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets (a) **or** (b) **and** (c) from the following criteria:

(a) the condition is at least 10-percent stocked by trees of any size (Appendix 2) or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities;

or

(b) in several western woodland types (see Appendix 2) where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.

and

(c) the prospective condition must be at least 1.0 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

ITEM 2404 STAND SIZE CLASS (CORE2.4.4)

Record the code that best describes the predominant size class of all live trees in the condition class that are not overtopped.

When collected: If SIMILAR CONDITION CLASS = 0 and PRESENT CONDITION STATUS = 1
Field width: 1 digit
Values:

0 Nonstocked:
Meeting the definition of accessible forest land, and one of the following applies:

(a) less than 10 percent stocked by trees of any size, and not classified as cover trees, or

(b) for forest types where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.

1 < 4.9 in (seedlings / saplings)
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 in DBH/DRC.

2 5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC and the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH, and/or western woodland trees 5.0 – 8.9 in DRC.

3 9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC and the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH, and for western woodland trees 9.0 – 19.9 in DRC.

4 20.0 – 39.9 in
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC and the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.

5 40.0 + in
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in trees ≥ 40.0 in DBH.

6 Cover trees (non-tallied):
Less than 10 percent stocking by trees of any size, and greater than 5 percent crown cover of species that comprise cover trees.

The instructions in Sections 2.1 and 2.3 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

Within the sampled area on microplot, subplot, or annular plot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. Use tree stocking of all live trees that are not overtopped to differentiate between stand-size classes; for most western woodland forest types (e.g., pinyon, juniper, gambel oak) where stocking values are not readily available, use percent tree cover to represent stocking.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5% of the crown cover in STAND SIZE CLASSES of 1,2,3,4, and 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is either 0 or 6 depending on the characteristics of the stand. If at least 1/3 of crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), the accessible forested condition will be classified in one of these STAND SIZE CLASSES based on which of these STAND SIZE CLASSES has the most crown cover. If less than 1/3 of the crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), classify the accessible forested condition as a STAND SIZE CLASS = 1, if adequate cover is present.

If no other condition class defining variables are different between accessible forest conditions, delineate on differences in STAND SIZE CLASS only for the following combinations:

Between Nonstocked (STAND SIZE CLASS = 0) or cover trees (STAND SIZE CLASS = 6) and any stocked forest land (STAND SIZE CLASS = 1, 2, 3, 4, or 5);
Between STAND SIZE CLASS = 1 and STAND SIZE CLASS = 3, 4, and 5;
Between STAND SIZE CLASS = 2 and STAND SIZE CLASS = 4 and 5; or
Between STAND SIZE CLASS = 3 and STAND SIZE CLASS = 5.

Note: Differing stand size classes can be used to describe separate condition classes, while at the same time not be used to delineate separate condition classes. Example: Two adjacent forested stands of the same forest type, one with a STAND SIZE CLASS = 1 and the other with a STAND SIZE CLASS = 2 could be delineated as separated CONDITION CLASS if one of the other condition class delineation variables differs (based on the rules), i.e. OWNER GROUP differs between the two condition classes. In addition, the STAND SIZE CLASS variables for the two condition classes would be recorded and treated as an ANCILLARY variable.

ITEM 2410 STAND AGE (CORE 2.4.10)

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for non-stocked stands.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for Site tree age, estimates of stand age should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

To estimate STAND AGE, select two or three dominant or codominant trees from the overstory. If the overstory covers a wide range of tree sizes and species, try to select the trees accordingly, but it is not necessary to core additional trees in such stands. The variance associated with mean stand age increases with stand heterogeneity, and additional cores are not likely to improve the estimate. Core each tree at the point of diameter measurement and count the rings between the outside edge and the core to the pith. Add in the number of years that passed from germination until the tree reached the point of core extraction to determine the total age of the tree. Add : longleaf — 7 years; other pines— 3 years; eastern hardwoods— 2 years, 5 years to western hardwoods, and 10 years to western softwoods. Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

$(34 \times 0.25) + (62 \times 0.60) + (59 \times 0.15) = 55$ years.

In some cases, it may be possible to avoid coring trees to determine age. If a stand has not been seriously disturbed since the previous survey, simply add the number of years since the previous inventory to the previous STAND AGE. In other situations, cores collected from site trees can be used to estimate STAND AGE.

If a condition class is nonstocked, assign a STAND AGE of 000.

If all of the trees in a condition class are not suitable to be bored for age (e.g. rotten cores, unable to read growth rings), then record 998. This code should be used in these cases only.

When collected: If SIMILAR IDENTIFIED CONDITION = 0 and PRESENT CONDITION STATUS = 1
Field width: 3 digits
Values: 000 to 997, 998, 999

3.0 BOUNDARY REFERENCES

No differences in boundary references.

4.0 SUBPLOT INFORMATION

No differences in subplot information.

5.0 TREE AND SAPLING DATA

The following tree and sapling data have special requirements for western woodland species:

Standing dead definition
ITEM 5040 AZIMUTH
ITEM 5050 HORIZONTAL DISTANCE
ITEM 5092 DIAMETER AT ROOT COLLAR (DRC)
ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT
ITEM 5170 COMPACTED CROWN RATIO
ITEM 5110 ROTTEN/MISSING CULL

STANDING DEAD

To qualify as a standing dead tally tree, dead trees must be standing (LEAN ANGLE = 0) at least 4.5 ft tall and be at least 5.0 inches in diameter. Broken portions of trees that are completely separated from their base are not treated as separate trees. For western woodland species (Appendix 3) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume.

ITEM 5040 AZIMUTH (CORE 5.04)

Record the AZIMUTH from the subplot center (for trees ≥ 5.0 in DBH/DRC) or the microplot center (for saplings 1.0 in and < 5.0 in DBH/DRC), sight the center of the base of each tree with a compass. Sight to the geographic center for multi-stemmed western woodland species. The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

Note: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits
Values: 001 to 360

ITEM 5050 HORIZONTAL DISTANCE (CORE 5.05)

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 ft, from the subplot center (for trees ≥ 5.0 in DBH/DRC) or microplot center (for saplings 1.0 in and < 5.0 in DBH/DRC) to the pith of the tree at the base. For all multi-stemmed western woodland trees (woodland species indicated in Appendix 3), the HORIZONTAL DISTANCE is measured from subplot or microplot center to the "geographic center" of the tree. The geographic center is a point of equal distance between all tallied stems for a given woodland tree.

Note: When SAMPLE KIND = 2, for microplot saplings that become subplot trees, crews must collect new azimuth and distance information from the subplot center.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits (xx.y)
Values: Microplot: 001 to 068
Subplot: 001 to 240

DIAMETER

Diameters are measured at either breast height (DBH) or at the root collar (DRC). Species requiring DRC, referred to as woodland species, are denoted with a “w” in Appendix 3. Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-ft radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-ft radius subplots.

ITEM 5092 DIAMETER AT ROOT COLLAR (DRC) (CORE 5.09.4)
For species requiring diameter at the root collar (refer to Appendix 3), measure the diameter at the ground line or at the stem root collar, whichever is higher. For these trees, treat clumps of stems having a unified crown and common root stock as a single tree; examples include mesquite, juniper, and mountain mahogany. Treat stems of woodland species such as Gambel oak and Rocky Mountain maple as individual trees if they originate below the ground. For multi-stemmed trees, compute and record a cumulative DRC (see below); record individual stem diameters and a stem status (live or dead) on a separate form or menu as required.

1 Measuring DRC: Before measuring DRC, remove the loose material on the ground (e.g., litter) but not mineral soil. Measure just above any swells present, and in a location so that the diameter measurements are reflective of the volume above the stems (especially when trees are extremely deformed at the base).

   Stems must be at least 1.0 ft in length and 1.0 inch in diameter to qualify for measurement; stems that are missing due to cutting or damage must have previously been at least 1.0 ft in length.

   Whenever DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme number of limbs), stems may be estimated and recorded to the nearest 1.0-in class.

   Additional instructions for DRC measurements are illustrated in Figure 23.

2 Computing and Recording DRC: For all tally trees requiring DRC, with at least one stem 1.0 inch in diameter or larger at the root collar, DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed DRC tree, the computed DRC is equal to the single diameter measured.

Use the following formula to compute DRC:

$$DRC = SQRT\ [SUM\ (\text{stem diameter}^2)]$$

Round the result to the nearest 0.1 in. For example, a multi-stemmed woodland tree with stems of 12.2, 13.2, 3.8, and 22.1 would be calculated as:

$$\begin{aligned} DRC &= SQRT\ (12.2^2 + 13.2^2 + 3.8^2 + 22.1^2) \\ &= SQRT\ (825.93) \\ &= 28.74 \\ &= 28.7 \end{aligned}$$

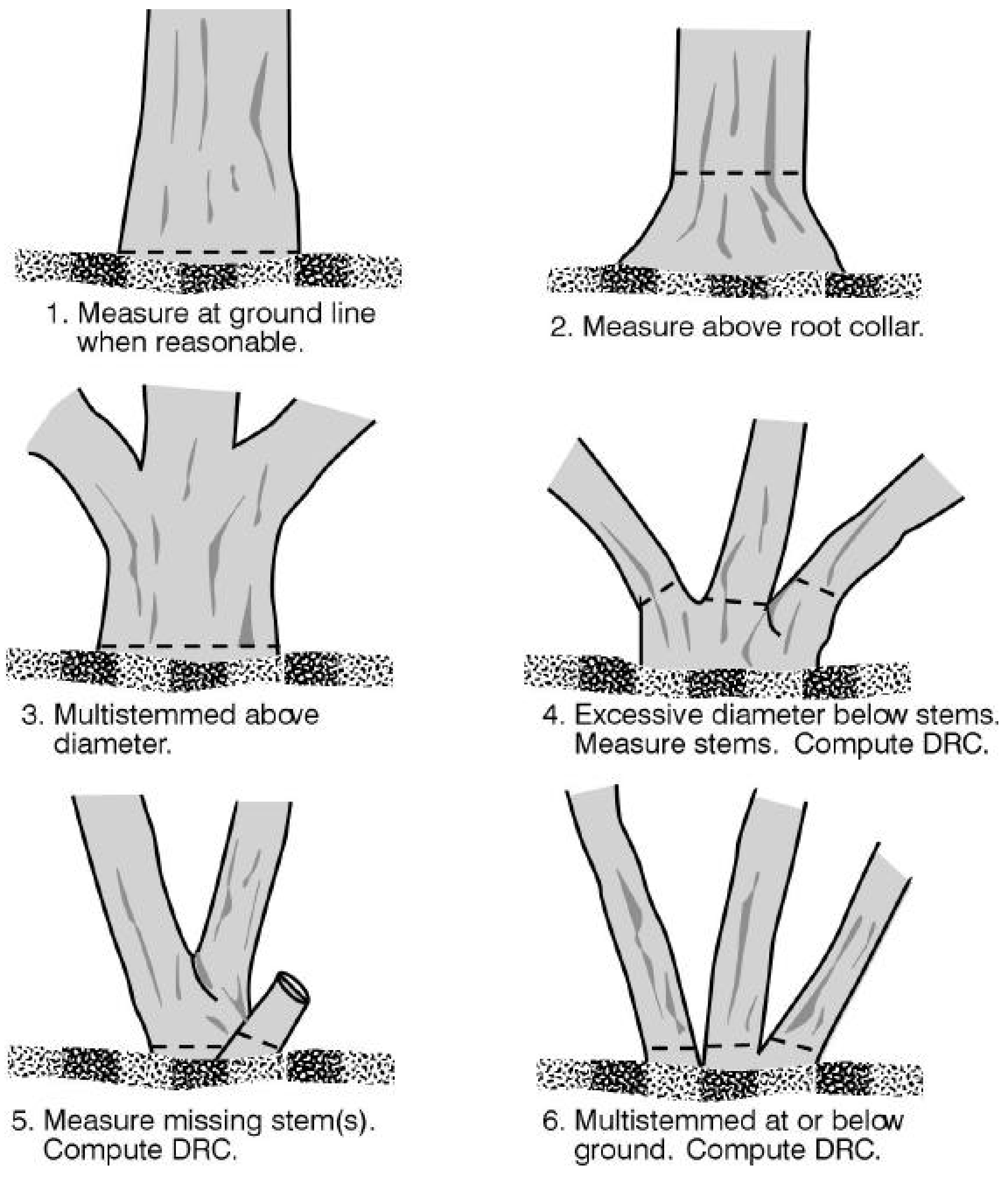


Figure 23. How to measure DRC in a variety of situations.

ITEM 5230 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.23)

For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual length from the ground, to the nearest 0.1 in, at which the diameter was measured for each tally tree, 1.0 in DBH and larger. Leave this item blank for western woodland species measured for diameter at root collar.

When Collected: All live and dead tally trees (except western woodland species)
Field width: 3 digits
Values: 001 – 150

ITEM 5170 COMPACTED CROWN RATIO (CORE 5.17)

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 in and larger to the nearest 1%. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage and is expressed as a percentage of the actual tree length. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2-feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 28).

When Collected: All live tally trees 1.0 in DBH/DRC
Field width: 2 digits
Values: 00 to 99

For multi-stemmed western woodland species, ocularly transfer lower live foliage to fill large holes on all stems and form an even crown across the tree (Figure 28).

ITEM 5110 ROTTEN/MISSING CULL (CORE 5.11)

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length. For western woodland species, the merchantable portion is between the point of DRC measurement to a 1.5-inch DOB top. See Appendix 3 for complete procedures and cubic foot volume table.

When Collected: All live tally trees $\geq$ 5.0 in DBH; all mortality trees $\geq$ 5.0 in DBH and TREE CLASS = 2
Field width: 2 digits
Values: 00 to 99

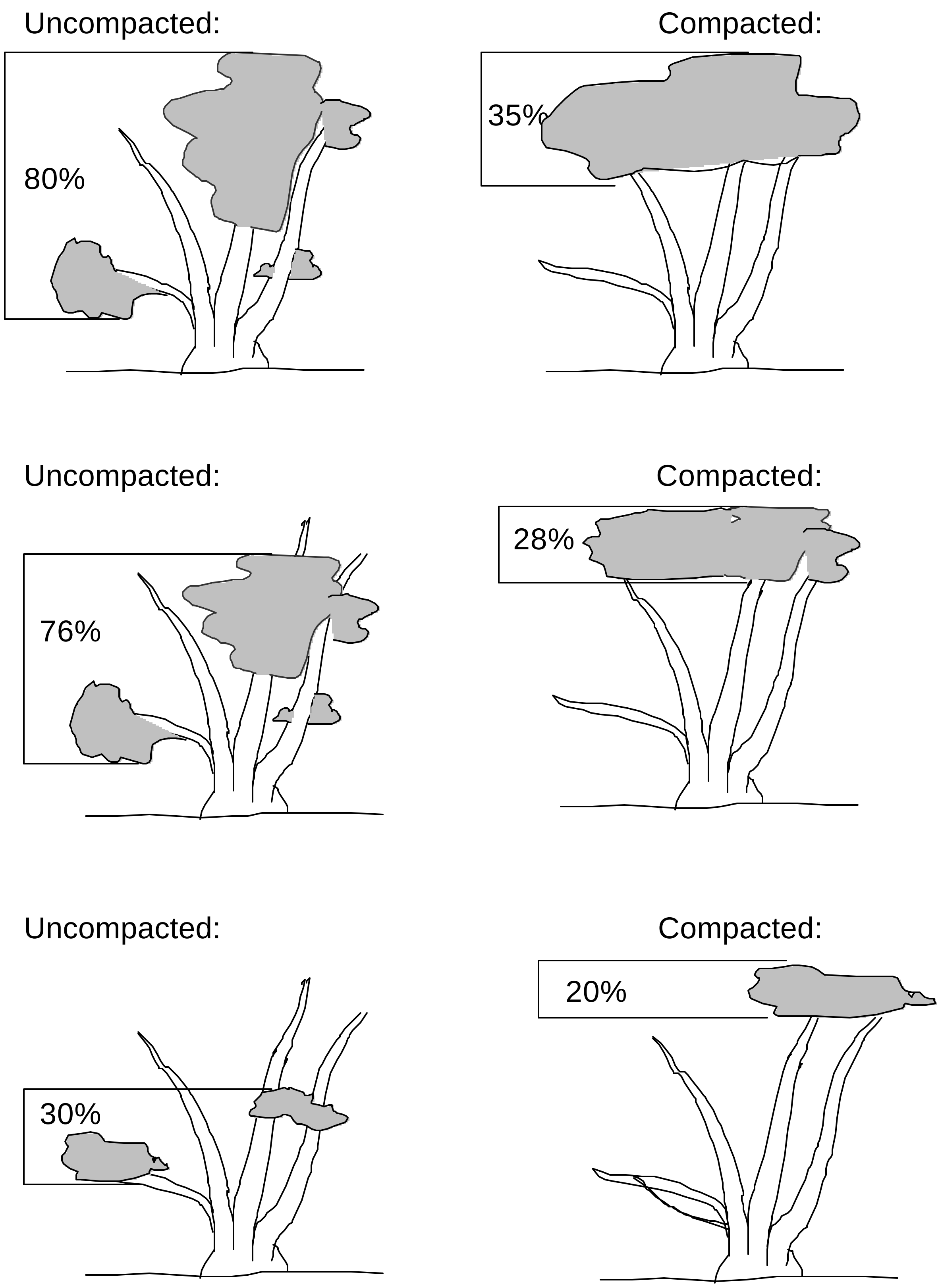


Figure 28. Examples of COMPACTED CROWN RATIO of western woodland species.

6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting seedlings within the 6.8 ft radius microplot located 90 degrees and 12.0 ft from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 in at DBH/DRC in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 in at DBH/DRC in order to qualify for tallying. For western woodland species, each stem on a single tree must be less than 1.0 inch in DRC. Seedlings are counted in groups by species and condition class, up to 5 individuals per species. Counts beyond 5 are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. Only count seedlings occurring in accessible forest land condition classes.

7.0 SITE TREE INFORMATION

Reject woodland species when selecting site tree species. See Appendix 4 for site tree selection criteria.

8.0 NONFOREST/DENIED ACCESS/HAZARDOUS/ INTENSIFICATION PLOTS

No differences in nonforest/denied access/hazardous/intensification plots.

NOTE: See Section 2.3.1 Accessible Forest Land in this supplement for a definition of forest land in western woodland forest types.

Section 9. Ozone Bioindicator Plants (West)

9.0 QUICK REFERENCE FOR THE OZONE INDICATOR

9.0.1 QUICK REFERENCE ON FIELD PROCEDURES FOR UNTRAINED FIELD CREWS

There are certain procedures for the ozone indicator that may be performed by individuals that have not attended the ozone training and been certified to collect ozone data. These procedures still require some explanation and oversight by the certified crew member. Untrained personnel may assist in the selection and mapping of the ozone biomonitoring site and in the location and identification of bioindicator species on the selected site. They may not rate plant injury. It may also be helpful for the untrained crew person to act as the data recorder for the certified crew member, thus speeding up the data collection process.

9.0.2 QUICK REFERENCE ON PDR SCREENS

Ozone indicator data are recorded on portable data recorders (PDR's) including Paravant, Husky, Handspring and Palm. Each of the tables below corresponds to a PDR data screen or portion of a screen that includes ozone measurement variables. The tables serve as a quick reference for the PDR application screens by indexing the Subsections in this chapter where the variables on each screen are defined. An "x" in one of these tables means that the variable is prompted for on the FIA Ozone Grid, and the field crew is required to complete that field. For a written summary of the data entry procedures, definitions, and codes for the ozone measurement variables refer to subsections 9.1.3 and 9.2 through 9.5. There is a PDR Field Manual and a User's Guide for the Palm that provide a self-guided tour of the data entry screens for the ozone indicator.

Table 9-1. Bioindicator Plot Identification Screen(Subsection 9.2 and 9.6)

Measurement Variables	PDR Prompt	SAMPLE KIND 1,2, and 3	FG Subsection
STATE	State	X	9.2.1
COUNTY	Cnty	X	9.2.2
OZONE HEXAGON NUMBER	Hex Num	X	9.2.3
PLOT NUMBER	PlotNum	Set to1	9.2.4
QA STATUS	QA Stat	X	9.2.5
CREW TYPE	CrewTyp	X	9.2.6
OZONE SAMPLE KIND	SampKnd	X	9.2.7
MONTH	Month	X	9.2.8.1
DAY	Day	X	9.2.8.2
YEAR	Year	Set to current year	9.2.8.3
OZONE GRID DENSITY	GridDen	X	9.2.9
PLOT SIZE	PlotSiz	X	9.2.10
ELEVATION	Elev	X	9.3.4
ASPECT	Aspct	X	9.2.11
TERRAIN POSITION	TerrPos	X	9.2.12
SOIL DEPTH	SoilDep	X	9.2.13
SOIL DRAINAGE	SoilDrn	X	9.2.14
PLOT WETNESS	PlotWet	X	9.2.15
DISTURBANCE	Distrb	X	9.2.16
INJURY CHECK	InjChk	X	9.2.17

Table 9-2. Plot Notes Screen (Subsection 9.5.1 and 9.6)

Measurement Variables	PDR Prompt	SAMPLE KIND 1,2, and 3	FG Subsection
REMARKS1	Rem1	X	9.5.1
REMARKS2	Rem2	X	9.5.1

Table 9-3. Bio Species Screen (Symptom Scoring, Subsection 9.4, 9.6.4 and 9.6.6)

Measurement Variables	PDR Prompt	SAMPLE KIND 1,2, and 3	FG Subsection
SPECIES	Species	X	9.4.1 and 9.6.4
AMOUNT	Amount	X	9.4.2 and 9.6.6
NUMBER OF PLANTS	NbrPlnt	X	9.4.3
SEVERITY	Severity	x	9.4.4 and 9.6.6

9.1 OVERVIEW

Air pollutants, such as ground-level ozone, are known to interact with forest ecosystems. Ozone is the only regional gaseous air pollutant that is frequently measured at known phytotoxic levels (Cleveland and Graedel 1979; Lefohn and Pinkerton 1988). Ozone pollution has been shown to have an adverse effect on tree growth and alter tree succession, species composition, and pest interactions (Forest Health and Ozone 1987; Miller and Millecan 1971; Smith 1974). In addition, we know that ozone causes direct foliar injury to many species (Skelly and others 1987; Treshow and Stewart 1973). We can use this visible injury response to detect and monitor ozone stress in the forest environment. This approach is known as biomonitoring and the plant species used are known as bioindicators (Manning and Feder 1980). In the enhanced FIA Program, ozone bioindicator plants are used to monitor changes in air quality across a region, and to assess the relationship between ozone air quality and Phase 2 / Phase 3 indicators of forest condition (e.g., growth increment and dieback).

A useful bioindicator plant may be a tree, a woody shrub, or a nonwoody herb species. The essential characteristic is that the species respond to ambient levels of ozone pollution with distinct visible foliar symptoms that are easy to diagnose. Field studies and/or fumigation experiments have identified ozone sensitive species and characterized the ozone specific foliar response for both eastern (Davis and Umbach 1981; Duchelle and Skelly 1981; Krupa and Manning 1988) and western (Richards and others 1968; Mavity and others 1995; Brace 1996) bioindicators. Foliar injury symptoms include distinct patterns of coloration, often associated with accelerated senescence.

This section describes procedures to select field sites for ozone biomonitoring using the FIA ozone grid, and to evaluate ozone injury on the foliage of sensitive plant species. Additional ozone sites, on an intensified ozone grid, may also be established by State and federal cooperators to improve the interpretive value of this indicator. This intensified sampling is done using the same methodology as the regular grid activities and is just as important.

9.1.1 SCOPE AND APPLICATION

The scope of this indicator is national, but procedures are amended regionally as needed, particularly with regard to suitable sites and target species. Other variables, such as number of species, number of plants, and methods of scoring are standardized nationally. The procedures, reporting, and assessment goals were developed with the following considerations:

1. Ozone plot distribution across the landscape covers both the more remote and expansive forests away from population centers and the more fragmented forests located in close proximity to urban areas;

2. Ozone plot stratification nation-wide reflects regional differences in air quality regimes and perceived risks to different forest types;

3. Sampling intensity in different regions is designed to allow links between ozone biomonitoring data and other FIA indicators;

4. Estimated errors for the ozone indicator measurements are kept below 10%; and

5. Seasonal variability in ozone injury is addressed. We know that ozone injury must reach an undefined threshold within a leaf before the injury becomes visible to the human eye, and then tends to be cumulative over the growing season until fall senescence masks the symptoms.

NOTE: There are certain regions of the country where ambient ozone concentrations, during the growing season, routinely exceed levels that are known to injure sensitive plants. Other regions have relatively clean air. In regions with poor air quality, the crew data underscore the extent and severity of ozone pollution in our national forests. In cleaner regions, the emphasis must be on establishing a baseline for the ozone indicator. In this regard, field crews collecting mostly zeros for the ozone injury variables are making a significant contribution to the national FIA database.

9.1.2 SUMMARY OF METHOD

Crew procedures include the selection of a suitable site for symptom evaluation, identification of one to three known ozone-sensitive species at the site, and identification of ozone injury on the foliage of up to 30 plants of each species. Each plant is evaluated for the percentage of injured area and severity of injury on a five-point scale. Field crews record information on the location and size of the opening used for biomonitoring and record injury amount and severity ratings for each plant.

In the East, to eliminate problems with seasonal variability in ozone response, all foliar evaluations are conducted during a four-week window towards the end of the growing season. In the West, due to differences in growing season, topography, target species, and other regional factors that influence plant response to ozone, the identification of an optimum evaluation window for this indicator is problematic. Nevertheless, to maintain national consistency and improve crew logistics, the western regions use a mid-season, five or six-week window for foliar injury evaluations.

In some States with a particular interest in air quality, foliar injury data are also collected from ozone sites on an intensified ozone grid. These supplementary ozone sites are standardized for certain site characteristics that influence ozone uptake by sensitive plants (Heck 1968; Krupa and Manning 1988), and are often co-located with physical air quality monitors. They are intended to improve the regional responsiveness of the ozone indicator.

Voucher specimens (pressed leaves with symptoms) are collected for each species for proper symptom identification. For each voucher, injury type and location codes are recorded to fully describe the injury observed in the field. Additional quality control measures include field audits and remeasurement of 10% of the biomonitoring sites.

The implementation of an ozone grid independent of the traditional FIA plot system allows greater flexibility in plot location on the ground and greater sampling intensity in areas believed to be at high risk for ozone impact. In addition, plots are deliberately chosen for ease of access and for optimal size, species, and plant counts, thus maximizing data quality. Ozone is a regional pollutant, understood to have regional effects on vegetation. Therefore, data collected on the ozone grid will have direct application to the FIA P2 and P3 plots within the same region.

No specialized safety precautions are necessary to complete the field work for the ozone indicator.

9.1.3 SUMMARY OF TALLY PROCEDURES, DEFINITIONS, AND CODES

All of the ozone bioindicator data are entered under Option 07 on the Tally main menu. For each biomonitoring site, you must select Option 07 from the Tally main menu and complete the three data entry screens for ozone data. The Bioindicator Plot Identification Screen (Table 9-1) includes a record of plot status and detail on site characteristics that influence ozone injury expression. The Plot Notes Screen (Table 9-2) prompts crews to add additional information that will help interpret the injury results and/or assist subsequent crews collecting data at the same location. The Bio Species Screen (Table 9-3 prompts crews for injury amount and severity codes on a plant by plant basis. This screen includes a pop-up menu, which keeps a running total of numbers of plants and species evaluated by the field crews. Help screens may be accessed for any variable, from any of the 3 screens presented under the Tally, Bioindicator Plants Option 07.

Ozone applications other than Tally also use three data entry screens as described above.

9.1.4 EQUIPMENT AND SUPPLIES

- A large diameter, 10X hand lens for close examination of plant leaves for ozone injury.
- Reference photographs and laminated leaf samples to aid in symptom identification.
- A small plant press with cardboard inserts to store leaf vouchers collected in the field.
- Stamped, addressed envelopes for mailing the leaf vouchers to the National Ozone Advisor.
- Stiff paper or cardboard for protecting the leaf vouchers in the mailing envelopes.
- Flagging: for temporary marking of sites or sample plants.
- Three field data sheets: (1) For documenting Foliar Injury Data in the event of a PDR failure; (2) For preparing the plot location map; and (3) For recording Voucher Leaf Samples Data for QA. (see Appendix 9.B).

9.1.5 TRAINING AND QUALITY ASSURANCE

Each field crew member is trained and tested for familiarity with the site selection, species selection, and data collection procedures, and their ability to recognize ozone injury and discriminate against mimicking symptoms. Although field crews are certified during the regular preseason training session, they must also participate in a refresher session held just prior to the beginning of the evaluation window for this indicator.

The National Ozone Advisor and one or more individuals in each region assume quality control responsibilities for the field season. Regional Advisors meet during a preseason session to refine methods and establish a unified approach to training, audits, and debriefing. Their responsibilities include: (1) training and certifying the State trainers and/or field crews as needed for their region, (2) documenting hot audits of the field crews, (3) overseeing the field crew refresher session held just prior to the evaluation window for this indicator, (4) assisting in the field with remeasurement procedures for symptom quantification, and (5) conducting a debriefing session for the indicator.

A field audit crew remeasures a subsample of the ozone ground plots in each region. Auditing procedures cover species selection, symptom identification, and quantification of injury, as well as foliar sample collection, preservation and shipment. Field crew supervisors audit the field crews and assist Regional Advisors and QA staff with remeasurement activities as needed.

Results of the field audits and remeasurement activities are used to determine if the measurement quality objectives are being met. Regional Advisors and Field Supervisors who are certified for the ozone indicator have the authority to implement whatever corrective action is needed in the field (e.g., retraining and retesting).

9.1.5.1 VOUCHER SPECIMENS

Leaf samples are collected by field crews, cooperators, and all QA staff. They are to be placed in a small plant press immediately after removal from the selected plant. This is to preserve the integrity of the leaf sample and the injury symptoms until they can be validated by the National Indicator Advisor. A data sheet identifying the field crew and plot location is to be filled out and mailed with each sample.

Field crews, cooperators, and all QA staff collect leaf samples on the ozone biomonitoring sites according to procedures outlined in Subsection 9.6.7. These voucher specimens are pressed and mailed to the National Indicator Advisor for validation of the ozone symptom. If QA staff and regular field crews happen to be evaluating the same site at the same time, they collect and mail separate vouchers.

9.1.6 COMMUNICATIONS

Any questions arising during the field season that cannot be answered by the Field Supervisor or State Coordinator, should be directed to the National Indicator Advisor for the ozone indicator or to the Western Regional Trainer. If field crews try and are unable to reach the National Advisor or the Western Regional Trainer they may call the Regional Advisor for the North Central States, as indicated below. Keep in mind that Advisors may be in the field and, therefore, unavailable for phone calls during normal workday hours. Messages left on answering machines should clearly identify who you are and when, where, and how to return your call. Please, be aware of differences in time zones and use email, if possible.

National Advisor (East and West)

Gretchen Smith Phone: (413) 545-1680
Holdsworth Hall (978) 544-7186 (< 7am + > 7pm)
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9.2 PLOT LEVEL DATA

All plot-level measurement codes for the ozone indicator are defined below. The codes and definitions are the same whether the crew is entering data using Tally (Paravant or Husky) or a personal data assistant (Handspring or Palm).

Ozone plots vary in size and do not have set boundaries. When describing plot-level characteristics, use the predominant characteristics where most of the plant species are located. If conditions vary markedly across the site, or by species, then describe this in the plot notes or on the site map. Specify the elevation, aspect, terrain position, soil depth, soil drainage, and disturbance for the highest priority species (Subsection 9.6.4) found on the site. For a complete explanation of the procedures associated with these measurement codes, refer to Subsection 9.6.

9.2.1 STATE

Record the unique FIPS code identifying the State where the plot center is located.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1

9.2.2 COUNTY

Record the unique FIPS code identifying the county where the plot center is located.

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1

9.2.3 OZONE HEXAGON NUMBER

Record the unique code assigned to each ozone hexagon. In some cases this will be a former FHM or P3 hexagon.

When collected: All plots
Field width: 7 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

9.2.4 PLOT NUMBER

This variable is preset to “1” and may not be visible on your PDR screen.

9.2.5 QA STATUS

Record the code to indicate the type of plot data collected.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 7

1 Standard ozone plot
2 Cold check
3 Not used
4 Training/practice plot (off grid)
5 Botched plot file
6 Blind check
7 Production plot (hot check)

9.2.6 CREW TYPE

Record the code to specify what type of crew is measuring the plot.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

1 Standard field crew
2 QA crew (any crew collecting remeasurement data)

9.2.7 OZONE SAMPLE KIND

Record the code that describes the kind of plot being visited.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 3

1 Initial plot establishment.
2 Remeasurement of a previously established plot.
3 Replacement of a previously established plot that was replaced because the original plot could not be relocated or because it no longer met ozone plot measurement criteria.

9.2.8 CURRENT DATE

Record the MONTH (2-digits), DAY (2 digits), and YEAR (4-digits) that the current plot was completed.

9.2.8.1 MONTH

Record the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

January	01	May	05	September	09
February	02	June	06	October	10
March	03	July	07	November	11
April	04	August	08	December	12

9.2.8.2 DAY

Record the day of the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

9.2.8.3 YEAR

Record the year that the plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: Beginning with 1998, constant for a given year

9.2.9 OZONE GRID DENSITY

Record the code that identifies whether the plot is on the base ozone grid or on an intensified ozone grid.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

1 Unique ozone plot within a polygon. (1 site:1 polygon)
2 One of two or more ozone plots within the same polygon.

9.2.10 PLOT SIZE

Record the code that indicates the size of the opening used for biomonitoring.

When collected: All plots
Field width: 1 digit
Tolerance:
MQO: Repeatable estimate
Values: 1 to 3

1 Greater than three acres (1.2 hectares).
2 Greater than one acre, but less than three acres (0.2 to 1.2 hectares).
3 Not used.
4 Not used.

9.2.11 ASPECT

Record the code that identifies the direction of slope for land surfaces with at least 5 percent slope as measured with a hand compass to the nearest degree.

When collected: All plots
Field width: 3 digits
Tolerance: +/- 30°
MQO: At least 99% of the time
Values: 0 to 360°

9.2.12 TERRAIN POSITION

Record the code that identifies the position of the plot in relation to the surrounding topography.

When collected: All plots
Field width: 1 digit
Tolerance: Repeatable estimate
MQO: At least 99% of the time
Values: 1 to 5

1 Ridge top or upper slope
2 Bench or level area along a slope
3 Lower slope

4 Flat land unrelated to slope
5 Bottom land with occasional flooding

9.2.13 SOIL DEPTH

Record the code that indicates the depth of the soil where most of the bioindicator species are growing.

When collected: All plots
Field width: 1 digit
Tolerance: Repeatable estimate
MQO: At least 99% of the time
Values: 1 to 2

1 Bedrock is not exposed.
2 Bedrock is exposed; Soil is generally shallow.

9.2.14 SOIL DRAINAGE

Record the code that identifies the soil drainage conditions where most of the bioindicator species are growing.

When collected: All plots
Field width: 1 digit
Tolerance: Repeatable estimate
MQO: At least 99% of the time
Values: 1 to 3

1 Soil is well drained
2 Soil is generally wet
3 Soil is excessively dry

9.2.15 PLOT WETNESS

Record the code that identifies the degree of wetness where most of the bioindicator plants are growing.

When collected: All plots
Field width: 1 digit
Tolerance: Repeatable estimate
MQO: At least 99% of the time
Values: 1 to 3

1 This is a wet plot; Riparian zone or bottomland.
2 This plot is moderately dry; Meadow or Northeast facing slope.
3 This plot is very dry; Exposed ledge, desert or alpine area.

9.2.16 DISTURBANCE

Record the code that identifies the presence and kind of disturbance where most of the bioindicator plants are growing. The area affected by any human caused or natural disturbance must be clearly visible and recent enough to influence plant health and condition. Disturbance that results in significant soil compaction is especially significant.

When collected: All plots
Field width: 1 digit

Tolerance: Repeatable estimate
MQO: At least 99% of the time
Values: 0 to 2

0 No recent or significant disturbance.
1 Evidence of overuse; Human activity causing obvious soil compaction or erosion.
2 Evidence of natural disturbance including fire, wind, flooding, grazing, pests, etc.

9.2.17 INJURY CHECK

Record the code that indicates whether ozone injury was observed on non-tallied plants or species. This variable allows a plot to be identified as impacted by ozone even though there is no quantitative data on injury severity for trend analyses. A leaf voucher must be collected to validate the injury.

When collected: All plots
Field width: 1 digit
Tolerance: No error
MQO: At least 99% of the time
Values: 0 to 1

0 No injury was observed on non-tallied plants or species.
1 Ozone injury was observed on non-tallied plants or species and a leaf voucher collected.

9.3 GPS COORDINATES

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all ozone plot locations. GPS readings are collected according to procedures outlined in the FIA National Core Field Guide for Phase 2 & 3 Plots, Version 1.6. The ozone data entry applications accept GPS readings obtained using a geographic coordinate system (not UTM). If you are using UTM, record readings on the field data sheet for mapping and on the PDR Plot Notes screen. <u>If GPS coordinates cannot be collected</u>, elevation and plot coordinates are obtained from USGS topographic maps, generally the 7½ minute series quadrangle. Record elevation on the Plot ID screen and approximate latitude and longitude on the Plot Notes screen.

NOTE: For several of the following GPS variables, the term plot center is used. There may be no obvious center to the ozone plots. Coordinates are collected as close as possible to a central location or marker that clearly locates the plot for returning crews. Explanatory notes are added to the plot map and Plot Notes screen as needed.

9.3.1 GPS UNIT

Record the kind of GPS unit used to collect coordinates. If coordinates cannot be obtained, record 0.

When collected: All plots
Field width: 1 digit

Tolerance: No errors
MQO: At least 99% of the time
Values: 0 to 4

0 GPS coordinates not collected
1 Rockwell Precision Lightweight GPS Receiver (PLGR)
2 Other brand capable of field averaging
3 Trimble GeoExplorer or Pathfinder Pro
4 Recreational GPS (Garmin, Magellan, etc.)

9.3.2 GPS SERIAL NUMBER

Record the last six digits of the serial number on the GPS unit used.

When collected: When GPS UNIT >0
Field width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000001 to 999999

9.3.3 GPS LATITUDE

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS.

When collected: When GPS UNIT = 1, 2, 3 or 4
Field width: 8 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values:

9.3.4 GPS LONGITUDE

Record the longitude of the plot center to the nearest hundredth second, as determined by GPS.

When collected: When GPS UNIT = 1, 2, 3 or 4
Field width: 9 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values:

9.3.5 GPS ELEVATION

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS. If no GPS Unit is available, record elevation from the appropriate USGS topographic map.

When collected: When GPS UNIT = 0,1, 2 or 4
Field width: 6 digits
Tolerance:
MQO: At least 99% of the time
Values: -00100 to 20000

9.3.6 GPS ERROR

Record the error as shown on the GPS unit to the nearest foot.

When collected: When GPS UNIT = 1 or 2

Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 0 to 70 if possible; 71 to 999 if an error of less than 70 cannot be obtained

9.3.7 NUMBER OF GPS READINGS

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT = 1 or 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 999

9.3.8 GPS FILENAME (CORE OPTIONAL)

Record the filename containing the GPS positions collected on the plot.

When collected: When GPS UNIT = 3
Field width: 8 characters.3 characters e.g. R0171519.ssf
Tolerance: No errors
MQO: At least 99% of the time
Values: Letters and numbers

9.4 FOLIAR INJURY DATA

All measurement codes for the BioSpecies screen (e.g., foliar injury data) are defined below. The codes and definitions are the same whether the crew is entering data on a PDR or personal data assistant (Palm). Plants selected for ozone injury evaluations are rated for the percent of injured area and the severity of injury on a scale of 0 to 5 (see Subsection 9.6.6). If a plant does not have injury, it is tallied with zeros for these measurements. A pop-up menu keeps track of plant counts by species. The plot is complete only after you have tallied 30 plants of at least 3 species, or when no additional plants can be found on the plot. Ozone plots vary in size and do not have set boundaries. Time and safety concerns should dictate how much ground area to cover to complete the foliar injury evaluation procedures.

9.4.1 SPECIES

Record the three-digit code that identifies each species on the plot. Codes for the bioindicator species are listed on the help screen for this variable. Species codes may be entered in the order they are encountered as you walk through the plot evaluating plants. A pop-up menu keeps a running total of numbers of plants and species evaluated.

When collected: All plots
Field width: 3 digits
Tolerance: No error
MQO: At least 90% of the time
Values:

9.4.2 AMOUNT

Record the code that identifies the percentage of leaves on the plant with ozone injury symptoms relative to the total number of leaves on the plant. The percent scale code and definitions are fully described in Subsection 9.6.6.

When collected: All plots
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 5 classes

0 No injury; The evaluated plant does not have any leaves with ozone symptoms.
1 1 to 6 percent of the leaves have ozone symptoms.
2 7 to 25 percent of the leaves are injured.
3 26 to 50 percent of the leaves are injured.
4 51 to 75 percent of the leaves are injured.
5 Greater than 75 percent of the leaves have ozone symptoms.

9.4.3 NUMBER OF PLANTS

Record the number of plants you have tallied so far with no injury. When 0 is entered for AMOUNT, the PDR prompts you for the NUMBER OF PLANTS with no injury. When a number greater than zero is entered for AMOUNT, the PDR prompts you for the associated SEVERITY value. You can enter zero and non-zero values for any species as they are encountered on the plot. The pop-up menu keeps track of plant counts by species so that you do not have to.

When collected: When AMOUNT = 0
Field width: 2 digits
Tolerance: No error
MQO: At least 90% of the time
Values: 1 to 30

9.4.4 SEVERITY

Record the code that identifies the mean severity of symptoms on injured foliage. The percent scale code and definitions are fully described in Subsection 9.6.6.

When collected: When AMOUNT > 0
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 5 classes

0 No injury. The evaluated plant does not have any leaves with ozone symptoms.
1 On average, 1 to 6 percent of the leaf area of injured leaves has ozone symptoms.
2 On average, 7 to 25 percent of the leaf area of injured leaves has ozone symptoms.

3 On average, 26 to 50 percent of the leaf area of injured leaves has ozone symptoms.
4 On average, 51 to 75 percent of the leaf area of injured leaves has ozone symptoms.
5 On average, greater than 75 percent of the leaf area of injured leaves has ozone symptoms.

9.5 PLOT NOTES

Use these fields to record notes pertaining to the entire plot. If the notes apply to a specific aspect of the plot, then make that clear in the notes. Record the location where GPS coordinates were collected, and GPS file name, as needed. If no GPS Unit was available, record the geographic coordinates (i.e., latitude and longitude) of the plot center in Degrees, Minutes, and Seconds using USGS topographic maps, generally the 7½ minute series quadrangle

9.5.1 Rem1 and Rem2

Record any information on site characteristics, safety, plant location, injury patterns, or recent rainfall amounts that will assist subsequent crews visiting the site or help interpret the results.

When collected: All plots
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

9.6 OZONE BIOMONITORING PROCEDURES

NOTE: In the following discussion the words site, biosite, and plot are used interchangeably to refer to the open area used for the ozone biomonitoring evaluations. Some plots or biosites will be new, established for the first time in 2002 on the new FIA ozone grid. Other plots have been established for many years as part of the FIA-P3 or FHM plot system. Both old and new plots have equal importance to the FIA program and are part of the national database for ozone biomonitoring.

The **primary objective** of the field crew procedures for the ozone indicator is to establish an ozone **biomonitoring site within each polygon on the FIA 2002 ozone grid**. These sites are used to detect and monitor trends in ozone air pollution injury on sensitive species. Procedures include the selection of a suitable site for symptom evaluation, identification of **three known ozone-sensitive species** at the site, symptom identification and scoring on the foliage of **30 plants of each** of three species, and the collection of voucher leaf samples. Each individual plant with ozone injury is scored for **amount and severity** of injury. Plants used for the selection of **leaf vouchers** are also evaluated for injury location and type. If a plant does not have ozone injury, it is still tallied with zeros for the amount and severity measurements. A hardcopy **map,** providing directions, plot coordinates, and key characteristics of the bioindicator site, is prepared for each plot.

All **foliar evaluations** are conducted during a mid-season ozone evaluation window. This helps address differences between plots that are caused by timing. During the evaluation window, **all ozone sites on the ozone grid are**

evaluated for ozone injury. The same sites are evaluated **every year**.

Site selection procedures depend on whether crews are establishing new ozone sites or revisiting established plots. However, procedures for species and plant selection, symptom identification and scoring, and collection of leaf samples for verification of the ozone symptom are the same for all crews.

9.6.1 EVALUATION WINDOW

Quantifying ozone injury on the FIA ozone plots is limited to an evaluation window starting in **July and ending in mid-August**. The evaluation window for crews in the Interior States begins 8 July and extends through 23 August. In the West Coast States, the window is open from 15 July through 23 August.

All established biomonitoring sites are evaluated each year. The ozone injury evaluations are generally completed over several weeks during the evaluation window depending on the size of the State and the number of crews dedicated to the ozone survey. If possible, crews should adjust the timing of their evaluations for differences in elevation and latitude so that low elevation sites and/or more southern States use the earlier dates of the window while higher elevation sites and/or more northern States delay until the mid to later dates. Similarly, within each State, the low elevation, more southern biomonitoring sites should be evaluated first, the higher elevation, more northern sites last.

9.6.2 SITE SELECTION PROCEDURES

Site selection procedures begin with an in-office review of the ozone grid for each state. Candidate sites must be easily accessible open areas greater than one acre in size that are more than 100 feet (30 m) from a busy (paved) road. A site must contain at least thirty individuals of at least two bioindicator species to be evaluated for ozone injury. It is preferable that all sites have three or more species. The following table may be used as a decision guide for site selection:

Decision Table	First Choice = **Best Site**	Second Choice
Access:	Easy	Easy
Size of Opening:	>3 acres (1.2h); wide open area <50% crown closure	Between 1-3 acres; long narrow or irregularly sized opening
Plant Numbers:	More than 30 plants of more than 3 species	More than 30 plants of 2 or 3 species
Site Moisture:	Wet or damp area; riparian zone, meadow, bottom land.	Moderately dry area; grassland or Northeast facing slope.
Site Conditions:	Good to adequate fertility; No recent disturbance or obvous soil compaction.	Exposed or rocky area; Little or no disturnbance.

NOTE: In many parts of the West, the forested landscape is characterized by large natural openings populated by a single overstory species. Large areas with a single bioindicator species (e.g., aspen or ponderosa pine) may be selected for biomonitoring, but every attempt should be made to combine this single species site with a nearby location that includes one or more of the understory bioindicator species. Nearby sites are combined under the same hexagon number. If site characteristics vary significantly, note this on the field data mapping sheet and on the Plot Notes screen of the PDR. Use your best judgment as to what constitutes a nearby site. Ozone is a regional pollutant, affecting large geographic areas, and sites within 3 miles of each other generally have the same ozone exposure regime.

States in the Interior and West Coast Regions, that are establishing ozone sites for the first time, complete the site selection procedures described below and map the best site that can be found within the confines of each grid polygon visited by the crews during the field season. The subsequent procedures for species and plant selection, and symptom quantification are completed only if the evaluation window is open at the time of site selection and establishment. Generally, crews are expected to complete two ozone sites in a ten-hour workday.

The best ozone sites are often associated with wildlife preserves on public land. Other examples of suitable openings include old logging sites and abandoned pasture or farmland where you are reasonably certain that soil/site conditions are stable and free of chemical contaminants. Private landowners are often eager to participate in the ozone program. State and county parks and wildlife openings also provide good ozone sites. Avoid open areas where plants are obviously stressed by some other factor that could mimic the ozone response. Do not select a site under a high-tension power line or on or near an active or reclaimed landfill. No more than **one half day** should be spent locating a new bioindicator evaluation site.

FIA crews and State Cooperators that have an established network of ozone sites are strongly encouraged to select and map new sites as needed throughout the field season, but the focus of the field activities should be on symptom quantification during the injury evaluation period. Once the evaluation window opens, crews complete the bioindicator measurements on all ozone sites on the grid. The logistics of completing the bioindicator measurements may vary from State to State depending on the numbers of plots and crews. Crews must provide **geographic coordinates (i.e., latitude and longitude)** for all newly established ozone sites.

9.6.3 SITE MAPPING

Once a bioindicator site is selected, the field crew records the estimated size of the site opening and other key site characteristics identified on the PDR or data sheet. The crew then **maps the location of the site** relative to some obvious and permanent marker such as a telephone pole, building, or property marker. Directions to the site, including road names and distances, are added to the map. Crews also **mark the starting point for plant selection** (see Subsection 9.6.5) **and approximate location of plant groupings** used for evaluation (see Subsection 9.6.6) on the site map. If available, a GPS unit is used to determine plot coordinates and elevation. Otherwise, this information is obtained from a USGS topographic map, generally the 7½ minute series quadrangle.

Ozone site maps are used by audit and regular crews in subsequent visits to the plot (see Figure 9-1). This bioindicator site map must be kept with the appropriate state or federal cooperator so that it is readily available to whoever needs it.

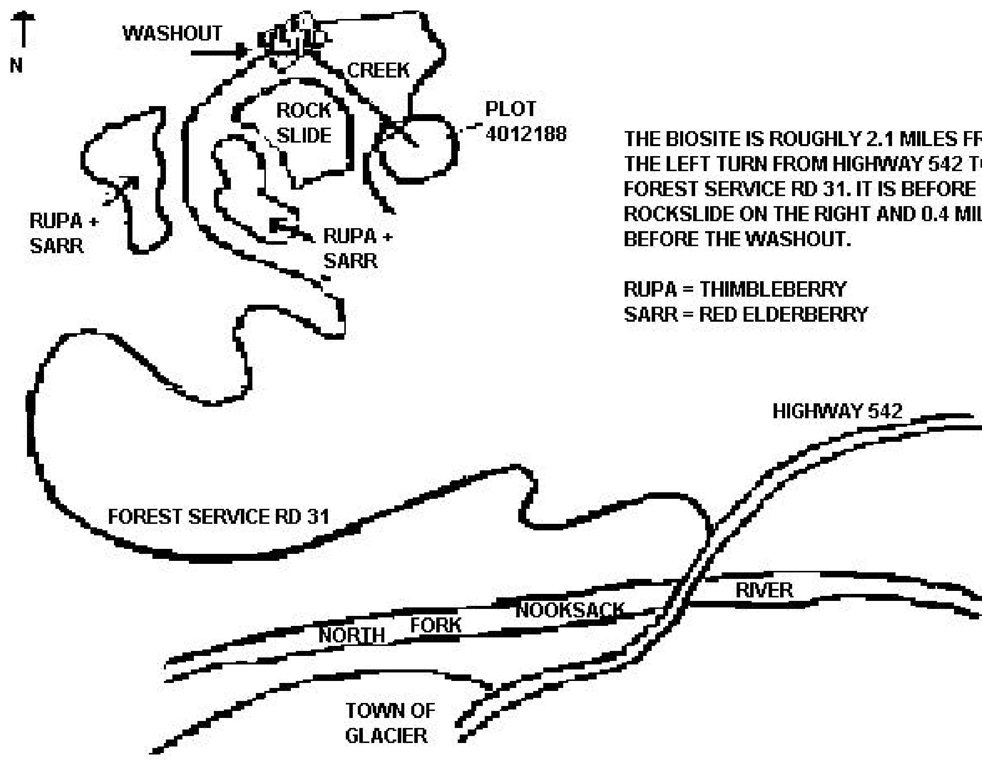

Figure 9-1. Example of a well-drawn map showing the location of the biosite and the approximate location of the bioindicator species and other key landmarks. Road names and North arrow are also included.

9.6.4 SPECIES SELECTION

At the selected bioindicator site, the crew evaluates **30 individuals of three or more bioindicator species**. If three species cannot be found at the site, then a lesser number of species is still evaluated. Crews may combine species and plant counts from neighboring locations to obtain the required plant counts for each site. If 30 plants of two or more species cannot be found at the site, then a new site or additional location must be selected. A list of species is provided to the field crews for each region. Crews are encouraged to select from the top of the list down when several species are found at the same site. However, species with 30 or more individual plants should be a first priority for choice of species. Key identifying characteristics of each species are provided in the Appendix 9.A. Species ID information can also be accessed from the ozone indicator web site: **fiaozone.net**

Field crews record the species code number for each selected species in the PDR or on the data sheet. The target species and codes for each region are:

Interior Region

Code	Definition	Scientific Names
122	Ponderosa pine[1]	*Pinus ponderosa*
746	Quaking aspen	*Populus tremuloides*
924	Scouler=s willow	*Salix scouleriana*
116	Jeffrey pine[2]	*Pinus jeffreyi*
351	Red alder[2]	*Alnus rubra*
905	Ninebark	*Physocarpus malvaceus*
965	Huckleberry	*Vaccinium membranaceum*
960	Blue elderberry	*Sambucus cerulea*
961	Red elderberry	*Sambucus racemosa*
909	Skunk bush	*Rhus trilobata*
907	Western wormwood	*Artemesia ludoviciana*
968	Evening Primrose	*Oenothera elata*
969	Mountain snowberry	*Symphoricarpos oreaphilus*

[1] *Pinus ponderosa* var. *scopulorum* (WY, CO)
[2] *Pinus jeffreyi* (NV); Alnus rubra (ID)

West Coast Region

Code	Definition	Scientific Names
122	Ponderosa pine[1]	*Pinus ponderosa*
746	Quaking aspen	*Populus tremuloides*
924	Scouler's willow	*Salix scouleriana*
818	California black oak[2]	*Quercus kellogii*
116	Jeffrey pine	*Pinus jeffreyi*
351	Red alder	*Alnus rubra*
905	Ninebark	*Physocarpus malvaceus*
906	Pacific Ninebark (WC)[3]	*Physocarpus capitatus*
965	Huckleberry	*Vaccinium membranaceum*
960	Blue elderberry	*Sambucus cerulea*
961	Red elderberry	*Sambucus racemosa*
909	Skunk bush	*Rhus trilobata*
907	Western wormwood	*Artemesia ludoviciana*
908	Mugwort	*Artemesia douglasiana*
968	Evening primrose	*Oenothera elata*
969	Mountain snowberry	*Symphoricarpos oreaphilus*

[1] *Pinus ponderosa* var. *ponderosa*
[2] This species is only found in southern Oregon (and south).
[3] WC = This species is only found west of the Cascades.

9.6.5 PLANT SELECTION

After site and species selection, the next task is to contiguously sample 30 individual plants of each species. Thirty plants of a target species must be sampled if they are available on site. In fact, crews are strongly encouraged to evaluate 150 plants at each site (30 plants of five species), if possible. The value of the bioindicator data increases significantly with increased numbers of plants evaluated. This is true even if the crew records 30 consecutive zeros on three different species.

NOTE: The borders of some biomonitoring sites are difficult to determine and crews may be uncertain how much ground area to cover to complete the plant selection procedures. Specific guidelines are not set because the constraints on crew time and resources vary considerably from one State to the next. Time and safety concerns should take priority. Each crew must make every effort to maximize the number of plants and species evaluated for ozone injury at each plot location. Generally, crews are expected to complete two ozone sites in a ten-hour workday.

The following procedures help the crews to collect the bioindicator data in as systematic (i.e., unbiased) a way as possible.

1. Identify a **starting point** for plant selection. This point is **mapped** on the site data sheet so that audit and regular crews evaluate roughly the same population of plants in subsequent visits to the plot.

2. Move away from the starting point, towards the **center of the opening**.

3. Begin locating individuals in a **sweeping pattern**, selecting plants that are growing under the same or similar growing (microhabitat) conditions. Do not skip plants with little or no injury.

4. Select the **more exposed plants** (high sunlight exposure) and avoid suppressed and shaded individuals. Plants along the edge of an opening may be used if, in your judgment, they receive direct sunlight for three to four hours each day.

5. **Avoid** plants under 12 inches in height or so tall that you cannot see or touch at least half of the crown area.

6. Evaluate the foliage that you can see and touch on **30 plants of each species** in the opening.

7. **Record** the amount and severity of injury for each plant evaluated (with or without symptoms) on the PDR or data sheet.

NOTE: A pop-up menu keeps track of the **plant counts** by species. You can tabulate more than three species and a limited sample number of 30 plants per species. Stop when the pop-up display indicates you have tabulated 30 plants of at least 3 species, or when no additional plants can be found on site.

NOTE: Some plants spread vegetatively. This means that neighboring plants are often genetically identical. To avoid repeat sampling of **clonal material**, take several steps between each plant selected for evaluation. Use a systematic approach to select individual plants. For example, select the plant closest to your left side then take two steps and select the plant closest to your right side and repeat. (A comparable systematic approach should be applied to all evaluated species to minimize bias in the plant selection process.) If it is difficult to distinguish individual plants or stems, use an approximate 2-foot square area to represent a single plant.

9.6.6 SYMPTOM IDENTIFICATION AND SCORING

The bioindicator species selected for each region are those that have been determined through field and laboratory studies to be highly sensitive to ozone air pollution. However, within a species, differences in **genetics** between individuals result in differential sensitivities to ozone. This means that you often find an individual of a species with severe air pollution injury growing immediately adjacent to another individual of the same species with few or no symptoms.

In addition to genetics, the **age of the leaves** (position on the stem, branch, or rosette) affects a plant's susceptibility to ozone air pollution. In general, leaves at 75% full expansion are the most sensitive and tend to show symptoms most definitively toward the center of the leaf. Older leaves show symptoms more widespread over the leaf surface, while younger leaves show symptoms more commonly near the leaf tip. If leaves on one branch are affected, then leaves at a similar leaf position on another branch should be affected, especially for branches on the same side of the plant under similar environmental conditions (sun or shade leaves).

All of the western bioindicator species, except ponderosa and Jeffrey pine, have broad leaves. When scoring foliar symptoms on these **broad-leafed plants**, check for the following characteristics of ozone injury:

C Symptoms are more severe on <u>mid-aged and older leaves</u>. New leaves will have no or very little injury.

C Symptoms are most likely confined to the <u>upper leaf surface</u>, and are typically visible as tiny <u>purple-red to black spots</u> (stippling).

C Check leaves covering each other. <u>Overlapped leaves</u> will have no injury on the bottom leaf.

C There will be some <u>uniformity</u> to size and shape of the lesions (stippling) on a leaf.

C Later in the growing season, stippling may be associated with leaf yellowing or premature senescence. Check the ground for fallen leaves.

On ponderosa and Jeffrey pine, the most common needle symptom is chlorotic mottle. When scoring foliar symptoms on **pines**, check for the following characteristics of ozone injury:

C Symptoms are visible as <u>diffuse yellow areas</u> (chlorotic mottle) without sharp borders between green and yellow zones, on older needles. Not all needles in a fascicle will be uniformly affected.

- Chlorotic mottle is rarely seen on current-year needles except in high-ozone areas. On young needles it may appear more olive than yellow.

- Older needles that are directly exposed to sunlight may show the most severe chlorotic mottle. However, almost all exposed branches on a plant will be affected to some degree.
- Premature needle drop frequently occurs on ozone-injured pines, even on trees that do not show other ozone injury symptoms. Check for missing older annual whorls and for large numbers of needles on the ground. Live crowns may appear small and thin.

NOTE: Missing whorls on ponderosa pine should not be recorded as ozone injury without reliable evidence of other foliar injury symptoms, such as chlorotic mottle.

Each plant (broadleaf and conifer) with ozone injury is evaluated for the **percent of the plant that is injured and the average severity of injury**. For each plant located, the percentage of injured area and the severity of injury are both rated on a scale of 0 to 5 (see below). Both AMOUNT and SEVERITY estimates are confined to the exposed portion of the plant. If a plant does not have injury, it is still tallied with zeros for these measurements. For broad-leaved species, the AMOUNT and SEVERITY estimates are based on injury to the upper surface area of the leaves. For the pine species, examine all needle surfaces including the under sides, particularly if the needles have large amounts of winter fleck (NOT an ozone injury symptom) on the upper surfaces.

Percent Scale for Injury AMOUNT: Estimate and record the percentage of leaves (or needles) on the plant with ozone injury symptoms relative to the total number of leaves (or needles) on the plant.

CODE	DEFINITION
0	No injury; the plant does not have any leaves/needles with ozone symptoms.
1	1 to 6 percent of the leaves/needles have ozone symptoms.
2	7 to 25 percent of the leaves/needles are injured.
3	26 to 50 percent of the leaves/needles are injured.
4	51 to 75 percent of the leaves/needles are injured.
5	>75 percent of the leaves/needles have ozone symptoms.

Percent Scale for SEVERITY of Injury: Estimate and record the mean severity of symptoms on injured foliage.

CODE	DEFINITION
0	No injury; the plant does not have any leaves/needles with ozone symptoms.
1	On average, 1 to 6 percent of the leaf area of injured leaves/needles have ozone symptoms.
2	On average, 7 to 25 percent of the leaf area of injured leaves/needles have ozone symptoms.
3	On average, 26 to 50 percent of the leaf area of injured

	leaves/needles have ozone symptoms.
4	On average, 51 to 75 percent of the leaf area of injured leaves/needles have ozone symptoms.
5	On average, >75 percent of the leaf area of injured leaves/needles have ozone symptoms.

NOTE: Red and blue elderberry have compound leaves. Use the whole leaf, not each leaflet, to estimate injury amount and severity.

NOTE: The percent scale for ozone injury evaluations has a long history of application in plant disease research. The scale utilizes break points that correspond to the ability of the human eye to distinguish gradations of healthy and unhealthy leaf tissue (see Horsfall and Cowling 1978).

Proceed as follows:

1. **Record the injury** AMOUNT and the injury SEVERITY ratings for each plant on the PDR or data sheet.

2. **Use the notes** section on the PDR or data sheet to add other information that will help interpret the results (e.g., below average rainfall for the area).

3. **Collect a voucher** leaf sample (three leaves of each injured species evaluated at each location) and mail them to the Western Regional Trainer using the guidelines presented in Subsection 9.6.7.

NOTE: Foliar symptoms are easiest to see under overcast skies. Bright sun will make it difficult to see the ozone stipple or chlorotic mottle. Stand so that you reduce the glare on the leaf/needle surface. Long periods without rain will inhibit symptom development even on the most sensitive plants. If you are experiencing below average rainfall for your area, please note this in the PDR or on the data sheet.

9.6.7 COLLECTION OF LEAF SAMPLES

The voucher leaf samples (leaves and/or needles) are a critical aspect of the data collection procedures as they provide the necessary validation of the ozone injury symptom observed in the field by the field crews. Crew data that do not include a voucher leaf sample are removed from the FIA database. A voucher leaf sample must be collected for each injured species evaluated on the bioindicator site. For example, if a field crew records ozone injury on red alder, Scouler=s willow, and ninebark then a minimum of **one voucher (3 leaves) from each of the three species (9 leaves in all**) is collected and mailed to the Western Regional Trainer. In this example, three voucher data sheets (one for each species) must be filled out and mailed with the leaf samples.

NOTE: The recognition of ozone injury symptoms in the field is not an exact science, and many other foliar injury symptoms can be mistaken for ozone injury. Crews are encouraged to collect voucher specimens of both known and suspected ozone injury in the field to send to the Western Regional Trainer for verification.

9.6.7.1 FIELD COLLECTION

For each injured, **broad-leaved species**, the voucher consists of three leaves that clearly show the ozone injury symptom. Ideally, these are three leaves with high amounts of foliar injury symptoms. If this is not possible, send whatever leaf sample is available even if it is only one leaf with faint symptoms. Cut the leaf at the petiole with hand clippers or a sharp knife.

For **pine species** with ozone injury, the voucher consists of two small branches (small terminal or lateral branch containing the full complement of needles) with obvious chlorotic mottle. If this is not possible, collect whatever needle sample(s) are available.

If the leaves/needles are wet when you cut them, shake off any excess moisture and pat dry. The samples do not have to be completely dry at this point. Place the samples into the **plant press** you were provided at training. Each leaf or branch sample is placed in the press so that it does not overlap another leaf. (Ozone symptoms become indistinguishable on leaves that overlap each other in the press so that the vouchers become useless.) Include a small **label** with each leaf sample you place into the plant press that identifies which plot the sample came from and the date. Labels are provided for this purpose. Record the information on the labels with indelible ink and then wrap them around the petiole (or stem) of one leaf per sample so that the backsides stick together and will not slip off the leaf. If you forget to take the plant press with you into the field, then place the leaves and accompanying label between pages of a notebook, or otherwise keep as flat as possible.

NOTE: Blue and red elderberry have compound leaves. Select the whole leaf (not individual leaflets) when preparing a voucher sample.

9.6.7.2 DATA COLLECTION

The plants from which the leaf vouchers are selected must be evaluated by the field crews for **INJURY LOCATION and INJURY TYPE**. This information, together with the visible injury symptoms on the leaf samples, will be used to validate the ozone injury data observed and recorded in the field by the field crews. Injury location and type are not specific to a particular plant but are, rather, representative codes of the sampled population. The injury location and type codes are recorded on the upper half of the voucher data sheet as follows:

INJURY LOCATION for Broad-leaved Species
Specify the leaf age or position of the leaves with ozone injury.

Code Definition

1 >50% of the injured leaves are younger leaves. Younger leaves are usually located towards the branch tip (e.g., aspen, willow, oak, ninebark, and huckleberry), or top of the plant (e.g., elderberry, wormwood and snowberry).

2 >50% of the injured leaves are mid-aged or older leaves. Mid-aged and older leaves are located halfway along the branch (e.g., aspen, willow, oak, ninebark, and huckleberry) or main stem of the plant (e.g., elderberry, wormwood, and snowberry), or more towards the base of the branch or stem.

3 Injured leaves are not concentrated in any one location, leaf age or position. Injury may be spread more or less evenly over the plant or is, otherwise, difficult to describe.

INJURY LOCATION for Pines

Specify the leaf age or whorl with ozone injury.

Code	Definition
1	>50% of the injured needles are on the current whorl.
2	>50% of the injured needles are on whorls 1 year old and older.
3	Injury is not concentrated on any one needle whorl but is spread more or less evenly along the branch or is, otherwise, difficult to describe.

INJURY TYPE for Broad-leaved Species

Specify the visible injury symptom.

Code	Definition
1	The injury on >50% of the injured leaves is best described as upper-leaf-surface stipple (i.e., tiny purple-red to black spots occurring between the veins). Stippling may be associated with leaf yellowing and leaf drop late in the growing season; When injury is severe, stipples may coalesce and appear as uniform discoloration of the leaf surface.
2	The injury on >50% of the injured leaves is something other than upper-leaf-surface stipple. For example, small white to tan flecks occurring between the veins, or injury that is clearly visible on both leaf surfaces, or a general discoloration of the leaf that resembles early fall coloration.
3	The visible injury is varied or, otherwise, difficult to describe.

INJURY TYPE for Pines

Specify the visible injury symptom.

Code	Definition
1	The injury on >50% of the injured needles is best described as chlorotic mottle i.e., small patches of yellow tissue with diffuse borders and surrounded by apparently healthy (green) tissue. Chlorotic mottle may be associated with premature needle drop.

2 The injury on >50% of the injured needles is something other than chlorotic mottle. For example, winter fleck on the upper surface of the needles, or tipburn (i.e., reddish brown discoloration of the needle tips).

3 The visible injury is varied or, otherwise, difficult to describe.

NOTE: Not all location and type codes are indicative of ozone injury. Certain combinations of location and type codes, considered with a questionable leaf voucher, may invalidate the injury data. Other combinations provide quality assurance for the injury assessment. Crews should describe any unusual or questionable symptoms on the upper half of the voucher data sheet.

9.6.7.3 MAILING PROCEDURE

Vouchers may be mailed in bulk at the end of the field season, or earlier, depending on your work schedule. It is very important to **mail only dry, pressed leaf samples**. Before mailing, make sure you have filled out the upper half of the voucher data sheet. This sheet is filled out on the same day the sample is collected, even if the sample is not mailed on that day. Please **comment on the weather** or general plot conditions that might help interpret the injury data. For example, *"It's been 14 days now without rain," "Every plant showed the same response and it was very obvious," or "This was a highly disturbed site."*

NOTE: Crews are encouraged to add information on the biosite location to the voucher data sheet such as the uncoded name of the county or closest town. This helps the Western Regional Trainer map the initial findings from the leaf vouchers and alert FIA staff to high ozone areas.

The lower half of the voucher data sheet is filled out by the Western Regional Trainer to whom you are sending the sample. Place the voucher data sheet and the leaf sample between two pieces of stiff paper or cardboard before placing into a mailing envelope addressed to the Western Regional Trainer. *Do not tape the leaves or needles to the paper or cardboard*. Taped samples often break apart when they are handled, making evaluation difficult. Include as many samples as fit easily into each mailing envelope. There must be a unique voucher data sheet for each sample or species.

NOTE: The Western Regional Trainer will make every effort to provide immediate **feedback** on the leaf vouchers. To facilitate this, crews must fill in the contact information on the voucher data sheet.

9.6.8 CREW MEMBER RESPONSIBILITIES

1. Although one or two crew partners may be trained for this indicator, one person typically takes the lead responsibility for site selection, plant selection, and ozone injury evaluations. All procedures can be successfully completed by one person. Two person crews are recommended for safety reasons.

2. All members of the field crew may assist each other in the site selection process. Once a site is selected, one crew member is responsible for mapping the site and the location of bioindicator species on the field data

sheet.

3. Only the crew member trained and certified in ozone injury evaluations may collect the amount and severity data and the leaf voucher. Other crew members may assist by recording the injury scores on the PDR or data sheet and by getting the plant press supplies ready.

4. The crew member that evaluates the plants for injury is responsible for collecting and mailing the voucher sample with air pollution symptoms.

9.6.9 SITE INTENSIFICATION

In addition to the unique ozone plots that are identified by the base FIA grid, some Cooperators have established additional biomonitoring sites to represent the local plant populations and environmental conditions. This is not an auxiliary effort, but an integral part of the monitoring activities for this indicator. In some States, additional biomonitoring sites are limited in number and are deliberately located close to weather and air quality monitoring stations. In other States, the ozone grid is intensified to allow for an unbiased allocation of additional biomonitoring sites. It is recommended that additional sites, whether few or many in number, be located on public land to facilitate the annual measurement activities.

Biomonitoring sites added to the base grid typically possess attributes of an ideal site for evaluating ozone injury on sensitive species. They are larger than three acres, contain the maximum number of indicator species, and have soil/site conditions with low drought potential and adequate fertility. They are evaluated for ozone injury using the same methods and during the same time frame as described above. Voucher leaf samples must be collected, according to procedures described in Subsection 9.6.7 and mailed to the National Indicator Advisor.

9.7 REFERENCES

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9.8 ACKNOWLEDGEMENTS

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Appendix 9.A Key Identifying Characteristics of the Ozone Bioindicator Species

1. ***Ponderosa Pine*** is a large tree, up to 70 meters in height. Young tree bark is often thin and dark brown to black. Older tree bark is thick becoming yellow-red to cinnamon red and forming plates which slough off freely. Needles in bundles of three, 12-26 cm in length, not glaucous and yellow-green in color. Buds are resinous with red-brown scales and dark-hairy. Cones with a prickle at the tip of each scale. May be confused with Jeffrey pine which differs by having non-resinous, light-brown buds, and grayish blue-green glaucous needles.

2. **Jeffrey Pine** is a smaller tree than ponderosa pine, with darker cinnamon-red bark that may be tinged with lavender on old trunks. Needles in bundles of three, 12-25 cm in length, blue-green, and somewhat twisted. Crushed needles and twigs have a violet-like or pineapple odor. Buds are *never* covered with resin droplets. Cones with a prickle at the tip of each scale. May be confused with ponderosa pine.

3. ***Quaking Aspen*** is a medium sized tree up to 36 meters in height. Bark is smooth, greenish-white. Buds shiny but not resinous. Leaf petiole is strongly flattened. The leaf blade is broadly ovate (almost round) with a tapering tip and finely toothed margins, upper surface smooth, lower surface covered with a bloom. Aspen could be confused with black cottonwood which differs in its resinous buds, rough bark and round leaf petioles.

4. ***Scouler's Willow*** is a small tree or shrub up to 10 meters in height. Leaf blade is 3-10 cm in length, narrowly elliptic with the widest portion toward the tip, entire to irregularly toothed margins, lower surface smooth, upper surface shiny. This willow is NOT restricted to riparian zones. It can be easily confused with a number of other willow species. The combination of leaves widest toward the tip (mostly rounded ends and narrowly tapered bases) and the tolerance for upland (drier) habitats makes this willow relatively easy to identify.

5. ***California Black Oak*** is a deciduous tree up to 25 meters in height. Bark becoming deeply furrowed, dark gray-brown to black. Leaves bright green and smooth on the upper surface, dull green and finely hairy on the lower surface, deeply lobed, tips of lobes with 1-4 teeth. Fruit is an acorn with the cup hairy on the inside. May be confused with Oregon white oak which differs by having rounded lobes and the acorn cap without hair inside.

6. ***Pacific Ninebark*** is a deciduous shrub 2-4 meters in height. Leaves alternate, 3 or 5 lobed (maple-like), 4-8 cm long, serrate, dark green and smooth above, paler and hairy below. Twigs red to grayish brown, splits longitudinally into long strips. Flowers small, white, borne in a cluster, stems hairy. Very similar to ninebark (see below) which is generally smaller, in drier habitats, and with densely hairy ovaries.

7. ***Ninebark*** is an erect, loosely branched shrub with maple-like leaves and shreddy bark. May be up to 2 meters in height. Leaves and flowers similar to Pacific ninebark except the ovaries are densely hairy. May be confused with

Douglas maple which has opposite leaves, or sticky currant, which has leaves that are sticky to the touch. Often associated with ponderosa pine and Douglas-fir forests at low to mid-elevation.

8. ***Huckleberry*** is an erect shrub 0.9 to 1.5 m high. Leaves 2.5 to 5.0 cm long, half as wide, thin and pale green on both surfaces, smooth or occasionally minutely hairy, margins toothed, apex and base both acute. Fruit deep purple to black round berry around 6 mm diameter. Twigs slender, green and ridged. Found on dry to moist sites, sun or shade. Similar, and often found with oval-leaved huckleberry which has entire (smooth) rather than toothed leaves.

9. ***Blue Elderberry*** is a tall deciduous shrub, sometimes tree-like, up to 6 meters in height. Twigs with a soft pith inside. Leaves opposite, pinnately compound, the 5-9 leaflets sharply serrate and strongly uneven at the base. Flowers small, white, flat-topped cluster. Fruit a blue-black berry covered with a white powdery bloom. This species could be confused with red elderberry which differs by having flowers in a spike and red-purple fruit. Found mostly on moist, well-drained sites in the sun; sea level to 9,000 ft.

10. ***Red Elderberry*** is a tall deciduous shrub, sometimes tree-like, up to 6 meters in height. Twigs with a soft pith inside. Leaves opposite, pinnately compound, the 5-7 leaflets sharply toothed and often uneven at the base. Flowers small, white, and clustered into a long spike. Fruit is a berry, most often red in color but sometimes purplish-black or yellow. Similar to blue elderberry which has a flat-topped flower cluster and a blue-black berry.

11. ***Western Wormwood*** is an aromatic perennial herb, 0.3 to 1.0 meter in height. Leaves mostly 3-11 cm long, variable in shape but most often with 3-5 narrow lobes, white hairy beneath, sometimes above as well. Flowers small and arranged in a loose, narrow flower cluster, 5-30 cm long. May be confused with Douglas' wormwood which has wider leaves and is usually found in moister habitats. Also similar to Riverbank wormwood which occurs only near streams and outwash areas.

12. ***Mugwort*** is a large perennial herb 0.5 to 1.5 meters tall, usually found in large colonies in wet areas, ditches, or drainages. Leaves are evenly-spaced, 1 to 10 cm long, the upper leaves are narrowly elliptical, the lower widely oblanceolate, often coarsely 3 to 5 lobed near the leaf tip, 2 to 3 cm wide, green above, covered with dense white hair beneath. Differs from western wormwood in having wider lower leaves and in its generally damp habitat.

13. ***Evening Primrose*** is a large biennial with elliptical leaves up to 25 cm long in a dense rosette the first year. The large (>1m) flowering stalk with long red-tinged elliptical leaves and large bright yellow four-petaled flowers forms in the second year. Both the leaves and stem are densely hairy, and the hairs often have red, blister-like bases. Usually found in moist, sunny habitats, like seeps or meadows.

14. ***Mountain Snowberry*** is a shrub, 0.5 to 1.5 meters in height with a solid brown pith. Bark: shreddy, brownish. Young twigs: hairy. Leaves opposite, elliptical, 1.0 to 3.5 cm long and half as wide. Flowers (May-June) tubular-shaped, the petals white with a pink tube. Fruit a white berry. Common

snowberry differs by having non-tubular flowers and a hollow pith. Trailing snowberry is a trailing shrub with non-tubular flowers; and Utah honeysuckle has larger leaves and a solid white pith.

15. ***Red Alder*** is a deciduous tree up to 20 meters tall with dark green leaves 6 to 12 cm long. The leaves are coarsely toothed, with smaller teeth on the leaf margins, and the leaf veins are also tightly inrolled. Red alder is a common tree in damp situations and is a frequent colonizer of clearings, especially following clearcuts in coniferous forests.

16. **Skunkbush** is a small, diffusively-branched shrub, 0.5 to 1 meter tall. The tips of the branches often droop down almost to ground level. The leaves are alternate, compound, with three leaflets, each of which is 3-lobed. The leaves resemble those of poison oak, but the leaflets of skunkbush are smaller, more hairy, and much more deeply-lobed. The leaves of skunkbush also emit a strong, ill-scented odor when crushed. However, if unsure, DO NOT crush the leaves of a shrub with three leaflets to determine the odor. Skunkbush is usually found on dry, open, brushy hillsides, while poison oak prefers damp or shaded forested areas and riparian habitats. Skunkbush is found throughout the southwest, from California and Arizona north to Colorado and Idaho.

Appendix 9.B Data Sheets

OZONE BIOINDICATOR PLANTS

Site Characteristics - West

To be filled out by the FIELD CREW or Cooperator:

State	County	Hexagon No. or Site ID	Month	Day	Year	Crew ID

<u>This sheet must be completed only if you have *not* entered this same information into the PDR, Bioindicator Plot ID screen.</u>

Ö **Please put a check mark beside the correct information. Please complete all data fields.**

Plot size:		**Terrain position:**	
	> 1.2 hectares (3.0 acres)		Ridge top or upper slope
	0.2 – 1.2 hectares (<1/2 – 3 acres)		Bench or level area along a slope
	Other: please describe		Lower slope
			Flat land unrelated to slope
			Bottom land with occasional flooding

Aspect: record aspect to nearest degree; code 000° = no aspect; code 360° = north aspect

Elevation: record elevation in feet or meters; estimate if necessary.	
Feet =	Meters =

Plot Wetness:		**Soil Drainage:**		**Soil Depth:**	
	Wet site *Ex:* riparian zones, bottomland.		Well-drained		Bedrock not exposed
	Moderately dry *Ex:* meadow, NE slopes.		Wet		Bedrock exposed
	Very dry *Ex:* exposed ledge, desert, alpine.		Excessively dry		

Disturbance: Disturbance on the site or in localized areas where the bioindicator plants are growing.	
	No recent or significant disturbance; Do not count disturbance >3 years old.
	Evidence of overuse; Human activity causing obvious soil compaction or erosion.
	Evidence of natural disturbance including fire, wind, flooding, grazing, pests, etc.

Ozone Sample Kind:	
	Initial plot establishment on the 2002 FIA ozone grid.
	Remeasurement of a previously established plot.
	Replacement of a previously established plot that was replaced to meet new site selection guidelines (or lost site).

Geographic Coordinates:

Latitude:		Longitude:	
Easting:	Northing:	+/-Error(ft.):	Grid Zone:

Comments: Include information on additional species in the area, safety, directions, or site characteristics that may be useful.

File this completed data sheet with the bioindicator site map in the ozone plot file.

OZONE BIOINDICATOR PLANTS - 2002

Foliar Injury Data – Use this sheet *only* if no PDR is available for data entry!

State	Cty	Hexagon No. or Site ID	Month	Day	Measurement Type (check one):
					___ Regular crew ___ QA crew

Record species code number (choose up to 3; use additional sheets for >3 species at one site): **122** Ponderosa Pine **116** Jeffrey Pine **746** Quaking Aspen **924** Scouler's Willow **818** California Black Oak **351** Red Alder **906** Pacific Ninebark **905** Ninebark **965** Huckleberry **960** Blue Elderberry **961** Red Elderberry **907** Western Wormwood **908** Mugwort **968** Evening Primrose **969** Mountain Snowberry **909** Skunkbush. Then use the codes from the percent injury scale to record the percent of the leaves or needles injured relative to the total leaf number (amount) and the average severity of symptoms on the injured leaves (severity).
0 = No injury; **1** = 1-6%; **2** = 7-25%; **3** = 26-50%; **4** = 51-75%; **5** = >75% [Add notes on back of sheet as needed.]

	Species Code		Species Code		Species Code	
Plant	amount	severity	amount	severity	Amount	Severity
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

OZONE BIOINDICATOR PLANTS

Data Sheet for Mapping the Bioindicator Site Location

To be filled out by the FIELD CREW or Cooperator:

State	County	Hexagon No. or Site ID	Month	Day	Year	Crew ID

PLGR Information: (Please fill in this information, if available)

Easting	Northing	+/- Error (ft.)	Grid Zone

Please include the following information on the map: (1) Location of the site relative to some obvious and permanent marker; (2) road names and distances as needed; (3) North arrow; (4) starting point for plant selection; (5) approximate location of plant groupings used for the ozone injury evaluations.

Attach the original of this map to the corresponding plot data sheet so that it can be used by audit and regular crews in subsequent visits to the plot. Mail a copy to the National Indicator Advisor the year that the site is established.

For sites that lack a standard 7-digit hex number, please provide approximate latitude and longitude.

Latitude:	Longitude:

OZONE BIOINDICATOR PLANTS
General Information

Preferred site characteristics:
$ large, easily accessible opening
$ good soil conditions
$ 30 plants of 3 or more species
$ free from chemical contaminants

Sampling the bioindicator site:
$ identify starting point (put on map)
$ select plants in a random manner
$ do not skip plants with little or no injury
$ avoid suppressed or shaded plants
$ evaluate leaves on each plant for amount and severity of injury

Ozone injury characteristics:
$ on broad-leaf plants injury is present on mid-aged and older leaves on the upper leaf surfaces
$ overlapped leaves will have no injury on the bottom leaf
$ stippled lesions are uniform in size and shape, most often tiny purple-red to black spots located between the veins on the upper-leaf surface
$ on pine, ozone injury is usually present on older needles as small patches of yellow tissue with diffuse borders, surrounded by green tissue
$ collect, press, and mail injured leaf samples for injury validation

Injury Scale

Percent Scale for Injury Amount: Estimate and record the percentage of leaves (or needles) on the plant with ozone injury symptoms relative to the total number of leaves (or needles) on the plant.

CODE	DEFINITION
0	No injury; the plant does not have any leaves or needles with ozone symptoms.
1	1 to 6 percent of the leaves have ozone symptoms.
2	7 to 25 percent of the leaves are injured.
3	26 to 50 percent of the leaves are injured.
4	51 to 75 percent of the leaves are injured.
5	>75 percent of the leaves have ozone symptoms.

Percent Scale for Severity of Injury: Estimate and record the mean severity of symptoms on injured foliage.

CODE	DEFINITION
0	No injury; the plant does not have any leaves or needles with ozone symptoms.
1	On average, 1 to 6 percent of the leaf area of injured leaves have ozone symptoms.
2	On average, 7 to 25 percent of the leaf area of injured leaves have ozone symptoms.
3	On average, 26 to 50 percent of the leaf area of injured leaves have ozone symptoms.
4	On average, 51 to 75 percent of the leaf area of injured leaves have ozone symptoms.
5	On average, >75 percent of the leaf area of injured leaves have ozone symptoms.

Species Codes

122 Ponderosa Pine
116 Jeffrey Pine
746 Quaking Aspen
351 Red alder
924 Scouler's Willow
818 California Black Oak
960 Blue Elderberry
961 Red Elderberry
965 Huckleberry
905 Ninebark
906 Pacific Ninebark
907 Western Wormwood
908 Mugwort
909 Skunkbush
968 Evening Primrose
969 Mountain Snowberry

Note: (1) The best biomonitoring site is a large opening or stand with <40 percent crown closure where many individuals (>30) of more than 2 species are growing under good conditions of soil nutrition and moisture. The site must be easy to access. (2) A leaf sample must be collected and mailed to the regional ozone expert for every species showing ozone injury symptoms on each site visited by the field crew. Failing to collect a leaf voucher means the data cannot be used.

Web Site address: fiaozone.net

OZONE BIOINDICATOR PLANTS

Data Sheet for the Voucher Leaf Samples

To be filled out by the FIELD CREW or Cooperator:

State	County	Hexagon No. or Site ID	Month	Day	Year	Tally No. or Crew ID

To be filled out by the Cooperator (only needed when the hex number and tally numbers are not known).

Ozone plot name or identification number	Name and e-mail address of data collector

Fill in the required codes. Code definitions are in the Field Guide. For quick reference, see below.

Bioindicator Species	Injury Location	Injury Type	Is the leaf sample injury close to 100% ozone stipple or chlorotic mottle or is some other leaf surface injury also present?
			Close to 100% ______ Estimated percent other _______

Notes: Add notes on the leaf samples, plot conditions, safety, and weather as needed.

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Species codes: 122 Ponderosa pine 116 Jeffrey pine 746 Quaking aspen 924 Scouler's willow 351 Red alder 818 California black oak 960 Blue elderberry 961 Red elderberry 965 Huckleberry 905 Ninebark 906 Pacific ninebark 907 Western wormwood 908 Mugwort 909 Skunkbush 968 Evening primrose 969 Mountain snowberry. *Injury Location codes:* 1 = greater than 50% of the injured leaves are younger leaves (broadleaf) or current whorl (pine); 2 = greater than 50% of the injured leaves are mid-aged or older (broadleaf) or on whorls 1 year and older (pine); 3 = injured leaves are all ages. *Injury type codes:* 1 = greater than 50% of the injury is upper-leaf-surface stipple (broadleaf) or chlorotic mottle (pine); 2 = greater than 50% is not stipple

Questions? Call your Regional Advisor. **West: Pat Temple (909) 680-1583**; North Central:Teague Prichard (608) 264-8883; South: Dan Stratton (828) 257-4350; National: Gretchen Smith (413) 545-1680 [gcsmith@forwild.umass.edu];

Mail this sheet with the leaf samples to :
[Note: One sheet for each species.]

Pat Temple
USDA FS, PSW Experiment Station
4955 Canyon Crest Drive
Riverside, CA 92506

QA/QC PERSON: To be filled out by the regional ozone expert.

Positive for ozone	Negative for ozone	Date validated	Date rechecked	Sample condition

Notes: Explanation of symptoms or questions for the data collector.

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